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Tatlawiksuk River Salmon Studies, 2004

Annual Report for Study 04-310
USFWS Office of Subsistence Management
Fisheries Information Services Division and
Bering Sea Fishermen's Association

by

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and

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Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	log_2, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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ABSTRACT

The Tatlawiksuk River is a tributary of the Kuskokwim River, and produces Chinook salmon *Oncorhynchus tshawytscha*, chum salmon *O. keta*, and coho salmon *O. kisutch* that contribute to intensive subsistence and commercial salmon fisheries downstream of its confluence. The Tatlawiksuk River weir is one of several projects operated in the Kuskokwim Area that form an integrated geographic array of escapement monitoring projects. Collectively, and in accordance with the State of Alaska's Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222), this array of projects is a tool to assure appropriate geographic and temporal distribution of spawners, and provide a means to assess trends in escapement that should be monitored and considered in harvest management decisions. Towards this end, Tatlawiksuk River weir has been operated annually since 1998 to determine daily and total salmon escapements for the target operational period of 15 June through 20 September; to estimate age, sex, and length compositions of Chinook, chum, and coho salmon escapement; to monitor environmental variables that influence salmon productivity; and to provide part of an integrated platform in support of other Kuskokwim Area fisheries projects.

In 2004, a resistance board weir was successfully operated on the Tatlawiksuk River from 15 June through 18 September. Escapements for the target operational period included 2,833 Chinook, 21,245 chum, and 16,410 coho salmon. Formal escapement goals do not exist for the Tatlawiksuk River; however, Chinook and coho salmon escapements were higher than in previous years, and the chum salmon escapement was above average. Age, sex, and length data indicate a relatively strong return of age-1.2 Chinook salmon and an unusually high abundance of age-0.2 chum salmon, patterns similar to what were seen throughout the array of Kuskokwim River salmon escapement monitoring projects in 2004. Information recovered at the weir from fish tagged in the mainstem Kuskokwim River suggest that Tatlawiksuk River salmon tend to migrate through the lower Kuskokwim River tagging site during the first half of the respective runs for each species. Tatlawiksuk Chinook salmon, in particular, are consistently among the earliest arriving Chinook salmon at the tagging site. Weir operations also supported collection of tissue samples from 100 coho salmon as part of a genetic stock identification study over the entire range of the species in the North Pacific Ocean.

Key words: Chinook salmon, *Oncorhynchus tshawytscha*, chum salmon, *O. keta*, coho salmon, *O. kisutch*, longnose suckers, *Catostomus catostomus*, escapement, age-sex-length, Tatlawiksuk River, Kuskokwim River, resistance board weir, radiotelemetry, mark–recapture, genetic stock identification, stock specific run timing

INTRODUCTION

The Kuskokwim River drains an area approximately 50,000 mi^2, or 11% of the total area of Alaska (Figure 1; Brown 1983). Each year mature salmon *Oncorhynchus spp.* return to the river and support intensive subsistence and commercial fisheries that have annually harvested about a million salmon between 1980 and 1997 (Ward et al. 2003). The subsistence fishery is a vital cultural component for most Kuskokwim Area residents, and subsistence salmon harvests contribute substantially to the regional food base (Coffing 1991, *Unpublished* a, b; Coffing et al. 2000). The commercial salmon fishery in the Kuskokwim Area, though modest in value compared to other areas of Alaska, has been an important component of the market economy of lower river communities (Buklis 1999; Ward et al. 2003).

Salmon that contribute to these fisheries spawn and rear in nearly every tributary of the Kuskokwim River basin; however, few spawning streams receive rigorous salmon escapement monitoring. Limited escapement data available for the Kuskokwim River inhibits the ability of management authorities to assess the adequacy of escapements and the effectiveness of management decisions. Tatlawiksuk River weir is one of several initiatives begun in the late 1990s to help address this data gap.

Historically, only 2 long-term, ground-based escapement monitoring projects have operated in the Kuskokwim River basin; the Kogrukluk River weir and Aniak River sonar (Ward et al. 2003). These tributaries constitute a modest fraction of the total Kuskokwim River basin, and salmon populations in them are not representative of the diversity of salmon populations that contribute to subsistence, commercial, and sport harvests, or do not take into account the overall ecosystem function in the Kuskokwim drainage. Other ground-based escapement monitoring projects have been developed within the Kuskokwim River basin, but these initiatives were short-lived (Ward et al. 2003). Inception of the Tatlawiksuk River weir in 1998, coupled with other initiatives begun in the late 1990s and beyond (Gilk and Molyneaux 2004; Kerkvliet et al. 2004; Stroka and Brase 2004; Stuby 2004) provides some of the additional escapement monitoring and abundance estimates required for sustainable salmon management (Holmes and Burtkett 1996; Mundy 1998).

Aerial stream surveys are periodically conducted on many tributaries using fixed-wing aircraft, but these surveys serve as abundance indices because they are flown only once each season (Ward et al. 2003). The distribution of survey streams is geographically skewed toward the lower Kuskokwim River basin because aerial surveys are restricted to clear water streams or lakes; tributaries in the middle and upper Kuskokwim River are oftentimes stained from organics or clouded by glacial silt, which hinder visibility. Escapement assessment through aerial surveys is also subject to a high degree of variability dependent on viewing conditions and the person doing the surveys (Ward et al. 2003).

The goal of salmon management is to provide for long-term sustainable fisheries by ensuring adequate numbers of salmon escape onto the spawning grounds each year. Since 1960, management of Kuskokwim River subsistence, commercial and sport fisheries has been the responsibility of the Alaska Department of Fish and Game (ADF&G). Management authority for the subsistence fishery was broadened in October 1999 to include the federal government under Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA). The U.S. Fish and Wildlife Service (USFWS) is the federal agency most involved within the Kuskokwim Area. In addition, tribal groups such as the Kuskokwim Native Association (KNA) are charged by their constituency to actively promote a healthy and sustainable subsistence salmon fishery. These and other groups have combined their resources to develop several new projects, including the Tatlawiksuk River weir, to better achieve the common goal of providing for long-term sustainability of salmon fisheries in the Kuskokwim River.

Sustainable salmon fisheries require more than just adequate escapement numbers. Escapement projects, such as Tatlawiksuk River weir, commonly serve as platforms for collecting other types of information useful for management and research. Collection of age, sex, and length (ASL) data is typically included in most escapement monitoring projects, and Tatlawiksuk River weir is no exception (Estensen 2002; Roettiger et al. 2004; Shelden et al. 2004; Zabkar and Harper 2004). Knowledge of ASL composition can provide insights into understanding fluctuations in salmon abundance and is used for developing spawner-recruit relationships used in formulating escapement goals (DuBois and Molyneaux 2000). Tatlawiksuk River weir also serves as a platform for collecting other types of information useful for management and research. Water temperature, water chemistry, and stream discharge (level) are fundamental variables of the stream environment that directly or indirectly influence salmon productivity and timing of salmon migrations (Hauer and Hill 1996; Kruse 1998; Quinn 2005). Since these variables can be affected by human activities (i.e., mining, timber harvesting, man made impoundments, etc.;

NRC 1996) or climatic changes (e.g., El Nino and La Nina events), data collection for such variables are included in the project operational plan, though water chemistry was last collected in 2002 (Linderman et al. 2003).

STUDY SITE

Tatlawiksuk River is a tributary of the middle Kuskokwim River basin and provides spawning and rearing habitat for Chinook, chum and coho salmon (ADF&G 1998). Small numbers of sockeye *O. nerka* and pink *O. gorbuscha* salmon also migrate in the river. Tatlawiksuk River originates in the foothills of the Alaska Range (Figure 2; Brown 1983). It flows southwesterly for 70 miles, draining an area of approximately 813 mi^2 before joining the Kuskokwim River at river mile (rm) 350. The weir is located approximately 3 miles upstream of the mouth. Throughout most of the river's course, it meanders across wide, flat valleys vegetated with white spruce and scattered birch or aspen. Black spruce is more characteristic in poorly drained areas of the basin, and dense stands of willow and alder occur on sand and gravel bars. Unnamed streams that join the Tatlawiksuk River from the southeast and northeast drain extensive bog flats and swampy lowlands in the lower reaches of the basin. The channel gradient of the lower 50 miles is approximately 8 ft per mile.

Local residents report Athabaskan groups once harvested salmon from Tatlawiksuk River using fish fences and traps into the mid 1900s (Andrew Gusty Sr., Resident, Stony River village, personal communication). Since 1968, biologists from ADF&G periodically observed salmon escapements in the mainstem Tatlawiksuk River by means of aerial surveys coincidental with peak Chinook and chum salmon spawning activity (Burkey and Salomone 1999; Schneiderhan *Unpublished*).

Senka's Landing is located on the mainstem of the Kuskokwim River, approximately 7 miles downstream from the mouth of Tatlawiksuk River. Senka's Landing is the homestead of the Gregory family, with 3 permanent residents living at the homestead. The Gregory's periodically sell gasoline for retail, and allow camp equipment used at the weir project to be stored over the winter. Senka's Landing does not have telephone service, but the Gregory's can be contacted through the bush message service offered by KSKO radio in McGrath.

Approximately 10 miles farther downstream, tucked among several islands, is the community of Stony River, population 43 (Williams 2000). This town does not have a grocery store, but gasoline can be purchased; however, availability is limited and unreliable. Several small air taxi carriers service Stony River from Aniak through scheduled stops 6 days a week.

OBJECTIVES

The annual objectives for the Tatlawiksuk River weir project (FIS 04-310) were to:

1. Determine daily and total annual escapements of Chinook, chum, and coho salmon to Tatlawiksuk River from 15 June through 20 September.

2. Estimate the age, sex, and length (ASL) composition of total Chinook, chum, and coho salmon escapements to Tatlawiksuk River from a minimum of 3 pulse samples, one collected from each third of the run, such that simultaneous 95% confidence intervals of age composition in each pulse (Chinook and chum) or over the entire run (coho) are no wider than 0.20 ($\alpha = 0.05$ and $d = 0.10$).

3. Recover tag numbers and associated information from chum and coho salmon in support of a tagging study being conducted on the mainstem Kuskokwim River.
4. Serve as a monitoring site for Chinook salmon equipped with radio transmitters deployed as part of a radiotelemetry study being conducted in the mainstem Kuskokwim River.
5. Monitor habitat variables including daily water temperature and daily water level.
6. Participate in the collection of salmon tissue samples for genetic analysis and stock identification.

METHODS

WEIR DESIGN AND INSTALLATION

The resistance board weir consisted of 2 principal components: the resistance board panels, which formed the face of the weir; and the substrate rail, which anchored the panels to the stream bed. The design is described in detail in Tobin (1994) with panel modifications described in Stewart (2002).

Installation of the weir followed the techniques described in Stewart (2003), using drysuits and snorkel gear to improve wading capability and complete underwater tasks. The weir was installed across the entire 210-ft channel. The substrate rail and resistance board panels covered the middle 190-ft portion of the channel, and fixed weir materials extended the weir 10-ft to each bank.

The substrate rail consisted of 10-ft sections of steel angle that were bolted end to end across the channel. Each rail section was attached to the stream bed with 6 rebar stakes, and secured to a duckbill anchor approximately 15-ft upstream. A polyethylene mesh apron extended from the rail 4 ft downstream to prevent scouring from turbulence behind the rail.

Each resistance board panel consisted of a 3-ft wide framework of 20-ft tubular plastic pickets sealed for positive buoyancy. The pickets were 1-5/16 in (3.33 cm) in diameter and spaced at intervals of 2-5/8 in (6.67 cm) to leave a gap of 1-5/16 in (3.33 cm) between each picket. One end of each panel was attached to the substrate rail and the other end floated 20-ft downstream. A plywood resistance-board mounted on the underside of each panel near its distal end was set to an inclined position causing the stream flow beneath to lift the distal end above the stream surface. When linked side by side the panels formed an array of pickets across the channel through which only small resident species and juvenile fish were able to pass. During flood conditions, panels would be forced below the water’s surface, allowing debris to pass unobstructed over the weir.

Vertical bulkheads were attached to each end of the weir. These were mated to the banks with fixed weir materials, consisting of ridged metal pickets supported by wooden tripods and metal stringers, to bridge the irregular profile. Sand bags were used to fill any gaps along the banks or beneath the rail.

A live trap and skiff gate were installed within the deeper portion of the channel. The live trap was also designed as the primary means of upstream fish passage. The trap could be easily configured to pass fish freely upstream, capture individual fish for tag recovery, or trap numerous fish for collection of ASL or genetic samples. The skiff gate allowed boat operators to pass with little or no involvement by the weir crew as the weight of a boat submerged the passage panels and allowed boats to pass over the weir. Boats with jet-drive engines were the most common and could pass up or downstream over the skiff gate after reducing their speed to 5 miles per hour or less.

The skiff gate consisted of 3 specially modified weir panels that allowed boats to travel over them. The resistance boards on the skiff gate panels were left unset so the distal ends of the panels laid flat on the water's surface. Weight of a passing boat submerged these panels, allowing boats to pass over the weir with little or no involvement by the weir crew. Modifications included scuff plates at the distal end of the panels to protect them from contact with boats, and special attachments at the base each panel to prevent them from unhooking from the substrate rail by the force of boats traveling upstream.

The live trap was used as the primary means of upstream fish passage so crew members could capture and recover information from fish tagged in the mainstem Kuskokwim River. It consisted of a welded aluminum frame 5-ft wide, 8-ft long, and 4-ft tall. The frame was placed immediately in front of the substrate rail and leveled with sand bags. Gates were installed on the upstream and downstream ends and 5-ft tubular steel pickets were inserted vertically around the remaining perimeter of the trap. The resulting picket spacing was the same as in the weir panels. A single weir panel was removed from behind the trap and vertical bulkheads were installed along either side of the opening to create a passage 3-ft wide into the trap. A sturdy walkway was placed around the top perimeter of the trap allowing crew to observe passage from either gate. A Plexiglas viewing window was placed on the stream surface to improve visual identification of fish entering the trap. This allowed passage counts to be conducted from the downstream entrance of the trap, and enabled crew members to capture tagged fish once they entered the trap.

A secondary passage gate could be employed if fish were discouraged from entering the live trap. Using the trap as a counting platform, a connecting picket would be removed between 2 nearby panels. By folding the panels to stand on edge, an opening 6-ft wide would be created. A rigid aluminum weir panel would be lashed to the upstream ends of the panels to serve as an easily removable gate. When removed for counting the gate would be placed on the river bottom, in front of the opening, to act as a flash panel for the identification of passing fish.

Alternatively, a weir panel could be removed from anywhere along the weir, and a crew member could wade next to the opening to conduct a passage count.

WEIR OPERATION

Monitoring Upstream Passage

Passage counts were conducted periodically during daylight hours. Substantial delays in fish passage occurred only at night or during ASL sampling. Crew members visually identified each fish as it passed upstream and recorded it by species on a multiple tally counter. Counting continued for a minimum of 1 hour, or until passage waned. Crew members recorded the total upstream fish count in a designated notebook and zeroed the tally counter after each counting session. At the end of each day, total daily and cumulative seasonal counts were copied to logbook forms. These counts were reported each morning to ADF&G staff in Bethel via single side band radio or satellite telephone.

Facilitating Downstream Passage

In late summer several resident species, especially longnose suckers *Catostomus catostomus*, typically migrate downstream past the weir site. To accommodate this migration, downstream passage chutes were incorporated into the weir once resident species were observed congregating just upstream. These chutes were created by simply releasing the resistance boards on 1 or 2 adjacent weir panels so the distal ends dipped slightly below the stream surface. Several downstream passage chutes were created along the weir in locations where downstream migrants were most concentrated. The chute's shallow profile directs downstream migrants over it and prevents salmon migrating upstream from finding it. The chutes were monitored and adjusted to ensure salmon were not passing upstream over them. Downstream passage was not enumerated, however few salmon have typically been observed passing downstream over these chutes, and these numbers are not considered significant.

Cleaning and Maintenance

The weir was cleaned several times each day, typically at the end of a counting shift. A technician walked across the weir to partially submerge each panel, thereby allowing the current to wash any debris downstream. A rake was used to push larger debris loads off the weir. Spawned out salmon and carcasses of dead salmon (both hereafter referred to as carcasses) that washed up on the weir, were counted by species and sex, and passed downstream. Daily carcass counts were copied to logbook forms. Each time the weir was cleaned, a visual inspection was made of weir panels, substrate rail, fish trap, and fixed weir sections to ensure no breaches would allow fish to pass upstream unobserved. If conditions prevented an adequate visual inspection, technicians used snorkel gear to ensure there were no breaches in the weir.

ESCAPEMENT DETERMINATIONS

Daily and total annual escapements consisted of the observed passage plus any estimated passage for Chinook, chum, and coho salmon during the target operational period. Counts of all other species were reported simply as observed passage.

Passage Estimates

Upstream salmon passage was estimated for days the weir was inoperable. Estimates were assumed to be zero if passage was considered negligible based on historical data and run timing indicators. Otherwise, estimates for a single day were calculated as the average observed passage 1–2 days before and after the inoperable day, minus any observed passage from the inoperable day. Daily estimates for inoperable periods lasting 2 or more days were derived by one of several methods, depending on the situation.

A "linear method" has commonly been used to extrapolate daily estimates from average observed passage 2 days before an inoperable period to average observed passage 2 days after the inoperable period. This method resulted in a linear increase or decrease in daily estimates over the duration of the inoperable period.

Daily estimates from this method were calculated using the formula:

$$\hat{n}_{d_i} = \alpha + \beta \cdot i\,,$$

$$\alpha = \frac{n_{d_1-1} + n_{d_1-2}}{2}\,, \tag{1}$$

$$\beta = \frac{\left(n_{d_I+1} + n_{d_I+2}\right) - \left(n_{d_1-1} + n_{d_1-2}\right)}{2\left(I+1\right)}\,,$$

for (d_1, 2, …, d_i, …d_I)

where:

$\hat{n}_{d_i}$ = passage estimate for the i^{th} day of the period (d_1, 2, …, d_i, …d_I) when the weir was inoperative;

n_{d_I+1} = observed passage of the first day after the weir was reinstalled;

n_{d_I+2} = observed passage of the second day after the weir was reinstalled;

n_{d_1-1} = observed passage of the 1 day before the weir was washed out;

n_{d_1-2} = observed passage of the second day before the weir was washed out and;

I = the number of inoperative days.

A "proportion method" was used if evidence supporting similar fish passage characteristics existed between estimated and model data sets. A model data set could be from a different year at Tatlawiksuk River, or from the same year at a neighboring project. In either case, daily passage was based on a model data set's daily passage proportions, and was calculated using the formula:

$$n_{d_i} = \left(\frac{\left(n_{2d_i} \times n_{1t_1}\right)}{n_{2t_1}}\right) - n_{o_i} \tag{2}$$

where:

n_{d_i} = passage estimate for a given day (i) of the inoperable period;

n_{2d_i} = passage for the i^{th} day in the model data set 2;

n_{1t_1} = known cumulative passage for the operational time period (t_1) from the estimated data set 1;

n_{2t_1} = known cumulative passage for the corresponding time period (t_1) from the model data set 2 and;

n_{o_i} = observed passage (if any) from the given day (i) being estimated.

AGE, SEX, AND LENGTH COMPOSITION OF ESCAPEMENT

Age, sex, and length compositions of the total annual Chinook, chum, and coho salmon escapements were estimated by sampling a fraction of fish passage and applying the ASL composition of those samples to the total annual escapement as described in DuBois and Molyneaux (2000).

Sample Collection

A pulse sampling design was used for Chinook and chum salmon, in which intensive sampling was conducted for 1–3 days followed by a few days without sampling. The goal for each pulse was to collect samples from 210 Chinook salmon and 200 chum salmon. These sample sizes were selected for simultaneous 95% confidence interval estimates of age composition proportions no wider than 0.20 (Bromaghin 1993). The minimum number of pulse samples was one per species from each third of the run. A season total minimum was 210 Chinook salmon or 200 chum salmon sampled from the duration of the run if pulse sample size goals are not met.

The coho salmon sample design was modified in 2003 to account for stability in ASL compositions over the duration of the coho salmon run. Pulse sample goals were replaced with a total run sample goal of 170 fish. The total run sample goal was divided between 3 pulse samples, each representing a third of the run.

Salmon were sampled from the fish trap installed in the weir. General practice was to open the entrance gate and leave the exit gate closed, which allowed fish to accumulate inside the holding pen. The holding pen was typically allowed to fill with fish and sampling was done during scheduled counting periods.

A dip net was used to capture individual fish from the trap. A specially designed cradle was used to hold a fish partially submerged while crew members collected samples. Scales were removed from the preferred area of the fish (INPFC 1963). A minimum of 3 scales were taken from each fish and mounted on numbered and labeled gum cards. Sex was determined by visually examining external morphology, keying on the development of the kype, roundness of the belly and the presence or absence of an ovipositor. Length was measured to the nearest millimeter from mideye to tail fork using a steel rule mounted to the cradle.

After each fish was sampled, it was placed in a recovery portion of the trap. This consisted of a narrow cell that held the fish fully submerged and facing the current. The front of the cell was open to the river upstream of the weir, and the fish would exit the trap under its own volition. This was done to prevent stressed fish from falling or swimming downstream onto the weir.

After sampling was completed, relevant information such as sex, length, date, and location was copied from hardcopy forms to computer mark-sense forms. Further details of sampling procedures can be found in DuBois and Molyneaux (2000) and Linderman et al. (2003). The completed gum cards and data forms were sent to the Bethel and Anchorage ADF&G offices for processing.

Weir crews conducted active sampling on Chinook salmon in an attempt to meet the pulse sample size objective. Active sampling consisted of capturing and sampling Chinook salmon while actively passing and enumerating all fish. Further details of the active sampling procedures are described in Linderman et al. (2002).

Estimating Age, Sex, and Length Composition

ADF&G staff in Bethel and Anchorage aged scales, processed the ASL data and generated data summaries as described in DuBois and Molyneaux (2000). These procedures generated 2 types of summary tables for each species; one described the age and sex composition and the other described length statistics. These summaries account for changes in the ASL composition throughout the season by first partitioning the season into temporal strata based on pulse sample dates, applying ASL composition of individual pulse samples to the corresponding temporal strata, and finally summing the strata to generate the estimated ASL composition for the season. This procedure ensured the ASL composition of the total annual escapement was weighted by abundance of fish in the escapement rather than the abundance of fish in the samples. Likewise, the estimated mean length composition for the total annual escapement was calculated by weighting the mean lengths in each stratum by the escapement of chum salmon past the weir during that stratum.

Ages were reported in the tables using European notation (Groot and Margolis 1991). European notation is composed of 2 numerals separated by a decimal, where the first numeral indicates the number of winters spent by the juvenile fish in fresh water and the second numeral indicates the number of winters spent in the ocean. Total age is equal to the sum of these 2 numerals, plus one to account for the winter when the egg was incubating in the gravel. For example, a Chinook salmon described as an age-1.4 fish under European notation has a total age of 6 years.

The original ASL gum cards, acetates and mark-sense forms were archived at the ADF&G office in Anchorage. The computer files were archived by ADF&G in the Anchorage and Bethel offices. Data were also loaded into the Arctic-Yukon-Kuskokwim (AYK) salmon database management system (Brannian et al. 2005).

HABITAT MONITORING

Daily weather and stream observations were taken in the morning and usually again in the late afternoon to monitor habitat variables. Air and water temperatures were measured using a thermometer calibrated in degrees Celsius. Stream temperature was determined by submerging the thermometer below the water surface until the temperature reading stabilized. Air temperature was obtained by placing the thermometer in a shaded location until the temperature reading stabilized. Temperature readings were recorded in the logbook, along with notations about cloud cover, wind direction and speed, and precipitation. Wind speed was estimated in miles per hour, and daily precipitation was measured using a rain gauge calibrated in millimeters.

Water level observations represented the stream height in centimeters above an arbitrary datum plane. Water levels were measured using a staff gage secured to a stake driven into the river bottom near the bank just downstream from the weir. The arbitrary datum plane was pegged to semi-permanent benchmarks intended to allow for consistency of measurements between years (Appendix A1). Benchmarks consisted of steel pipe sections driven into the bank. These were driven nearly flush with the gravel to protect them from ice flows during break-up.

CHINOOK SALMON RADIOTELEMETRY

Tatlawiksuk River weir served as a monitoring site for radio-tagged Chinook salmon in 2004 as part of a mark–recapture project in the Kuskokwim River (Stuby 2005). This study was designed to incorporate escapement data from various projects including the Tatlawiksuk River weir, to estimate run abundance of Chinook salmon in the Kuskokwim River drainage upriver from

Kalskag. A radio receiver station was placed 100-yd upstream of the weir to monitor movement of tagged Chinook salmon past the weir. The primary role of the Tatlawiksuk River weir was to provide Chinook salmon escapement and ASL data for this project. The weir crew made no attempt to capture radio-tagged Chinook salmon as these fish were monitored by a radio-tracking station located at the weir site and later noted by aerial overflights.

SOCKEYE, CHUM, AND COHO SALMON TAG RECOVERY

Detailed methods of the *Kuskokwim River Sockeye, Chum, and Coho Salmon Tagging Study, 2004* will be presented in Pawluk et al. (*In prep*). Tatlawiksuk River weir served as a tag-recovery site for this project. The crew gathered 3 sets of data in association with this study: (1) recaptured tag numbers, (2) total tagged fish observed, and (3) a secondary mark sample. Recaptured tag numbers and tagged fish observed data were used in generating abundance and run timing estimates, and the secondary mark sample was used for determining any tag loss.

GENETIC SAMPLE COLLECTION

Crew members collected fin clips from 100 coho salmon at Tatlawiksuk River weir for genetic analysis by the U.S. Fish and Wildlife Service as part of *Genetic variation among coho salmon populations from the Kuskokwim River region and application to stock-specific harvest estimation* (Crane et al. *In prep*). Genetic samples were gathered during each of 3 ASL sampling pulses to better approximate the genetic composition of Tatlawiksuk River coho salmon. The collection of tissue samples was done concurrently with standard ASL techniques. A thumbnail sized piece of caudal fin was removed, blotted dry, and placed in a vial of isopropyl alcohol. Strict care was taken to prevent contamination. Vials were numbered, and the corresponding sex, location, and sampling date were recorded. The tissue samples were sent to the USFWS genetics laboratory in Anchorage for analysis.

RESULTS

FISH PASSAGE AND SALMON ESCAPEMENTS

Total annual escapements of 2,833 Chinook, 21,245 chum, and 16,410 coho salmon were determined at Tatlawiksuk River weir during the target operational period of 15 June through 20 September, 2004 (Table 1). The weir remained operational from 15 June through 18 September. Chinook, chum, and coho salmon passage was estimated for 19 and 20 September, when the weir was removed.

Chinook Salmon

The total annual Chinook salmon escapement consisted of an observed passage of 2,833 fish, and an estimated passage of 0 fish. Chinook salmon passage was assumed to be zero for the inoperable period during 19 and 20 September, based on available run timing and passage data. The first Chinook salmon was observed on 15 June, the first day of operation, and the last Chinook salmon was observed on 2 September (Table 1). Daily passage peaked at 315 fish on 1 July. Based on total annual escapement during the target operational period, the median passage date was 5 July and the central 50% of the run occurred between 1 and 11 July.

Chum Salmon

The total annual chum salmon escapement consisted of an observed passage of 21,245 fish and an estimated passage of 0 fish. Chum salmon passage was assumed to be zero for the inoperable period of 19 and 20 September, based on available run timing and passage data. The first chum salmon was observed on 15 June, the first day of operation, and the last chum salmon was observed on 16 September (Table 1). The peak daily passage was 967 fish on 13 July. The median passage date was 14 July and the central 50% of the run occurred between 5 July and 21 July, based on total annual escapement during the target operational period.

Coho Salmon

The total annual coho salmon escapement consisted of an observed passage of 16,410 fish and an estimated passage of 0 fish. Estimated passage was determined for 19 and 20 September, using the "projection" method and data from the previous 5 days. The first coho salmon was observed on 20 July, and the last coho salmon was observed on 18 September, the last day of operations (Table 1). The peak daily passage was 825 fish on 22 August. The median passage date was 19 August and the central 50% of the run occurred between 12 August and 25 August, based on total annual escapement during the target operational period.

Other Species

Other species observed passing upstream of the weir in 2004 included sockeye salmon *O. nerka*, whitefish *Coregonus sp*., Arctic Grayling *Thymallus arcticus*, and Northern Pike *Esox lucius*. No pink salmon *0. gorbuscha* were observed. A total of 10 sockeye salmon passed from 19 July through 18 September (Appendix B1).

Carcass Counts

Salmon carcass counts in 2004 included 8 Chinook salmon, 707 chum salmon, and 11 coho salmon (Appendix C1). Carcasses were removed from the weir from June 23 (chum salmon) through September 14 (coho salmon).

AGE, SEX, AND LENGTH COMPOSITION

Samples were collected from 352 Chinook, 1,443 chum, and 423 coho salmon to determine ASL composition of escapements in 2004. Ages were obtained from 86% of the Chinook samples, 90% of the chum salmon samples, and 85% of the coho samples collected.

Chinook Salmon

Age, sex, and length were determined for 301 Chinook salmon, or 10.6% of the total annual escapement in 2004 (Table 2). The samples were collected in 3 pulses with sample sizes of 168, 107, and 26 fish. The run was partitioned into 3 temporal strata based on sampling dates. As applied to the total annual Chinook escapement, age 1.3 was the most abundant age class (40.6%), followed by age 1.4 (32.9%), and age 1.2 (26.5%). Female Chinook salmon composed 32.6% of the total annual escapement.

Male Chinook salmon ranged in length from 460 to 753 mm at age 1.2, 599 to 853 mm at age 1.3, and 662 to 1,010 mm at age 1.4, with mean lengths of 592, 704, 821 mm respectively. Female Chinook salmon ranged in length from 662 to 834 mm at age 1.3, and 686 to 980 mm at age 1.4, with mean lengths of 728 and 823 mm respectively (Table 3).

Chum Salmon

Age, sex, and length were determined for 1,299 chum salmon, or 6.1% of the total annual escapement in 2004 (Table 4). The samples were collected in 7 pulses with sample sizes ranging from 151 to 222 fish. The run was partitioned into 7 temporal strata based on sampling dates. As applied to the total chum salmon escapement, age 0.4 was the most abundant age class (43.1%), followed by age 0.3 (42.1%), and age 0.2 (14.6%). Age-0.4 chum salmon dominated early in the run, age-0.3 fish were more prevalent in the middle of the run, and age-0.2 fish was a strong component late in the run. Female chum salmon composed 38.7% of the total annual escapement.

Male chum salmon ranged in length from 450 to 598 mm at age 0.2, 484 to 652 mm at age 0.3, and 504 to 682 mm at age 0.4, with mean lengths of 543, 572, and 595 mm respectively. Female chum salmon ranged in length from 403 to 590 mm at age 0.2, 403 to 639 mm at age 0.3, and 402 to 638 mm at age 0.4, with mean lengths of 519, 544, and 561 mm respectively (Table 5).

Coho Salmon

Age, sex, and length were determined for 361 coho salmon, or 2.2% of the total annual escapement in 2004 (Table 6). The samples were collected in 4 pulses with sample sizes ranging from 58 to 183 fish. The total run sample was partitioned into 3 temporal strata based on sampling dates. As applied to the total coho salmon escapement, age 2.1 was the most abundant age class (94.4%), followed by age 1.1 (3.1%), and age 3.1 (2.5%). Female coho salmon composed 50.6% of the total annual escapement.

Male coho salmon ranged in length from 505 to 536 mm at age 1.1, 385 to 623 mm at age 2.1 and 484 to 612 mm at age 3.1, with mean lengths of 517, 546, and 518 mm respectively. Female chum salmon ranged in length from 474 to 547 mm at age 1.1, 408 to 613mm at age 2.1, and 504 to 570 mm at age 3.1, with mean lengths of 496, 545, and 537 mm respectively (Table 7).

HABITAT VARIABLES

A total of 200 complete observations of weather and stream conditions were recorded between 5 June and 21 September of the 2004 field season (Appendix D1). Air temperature ranged from 0–33°C. Water temperature ranged from 4–20°C.

CHINOOK SALMON RADIOTELEMETRY

Results for the Chinook salmon radiotelemetry study will be reported in Stuby (2005). A total of 5 radio-tagged Chinook salmon were detected passing the Tatlawiksuk River weir in 2004.

SOCKEYE, CHUM, AND COHO SALMON TAG RECOVERY

Results for the sockeye, chum, and coho salmon tagging study in 2004 will be reported in Pawluk et al. (*In prep*). Tag recovery efforts at the Tatlawiksuk River weir included recovery (i.e. fish captured and tag number recorded) of 2 of the 3 sockeye salmon observed with tags, 7 of the 8 chum salmon observed with tags, and 33 of the 35 coho salmon observed with tags, resulting in a 91% overall recovery rate. No secondary tag marks were found among 1,443 chum salmon and 353 coho salmon examined without tags.

GENETIC SAMPLE COLLECTION

Fin clip samples were collected from 100 coho salmon for genetic analysis of population structure and genetic stock identification in Anchorage. Results of this study will be reported in Crane et al. (*In prep*).

DISCUSSION

OPERATIONS

All project objectives were achieved in 2004. The weir was installed on schedule and was successfully operated between 15 June and 18 September, all but the last 2 days of the target operational period in 2004. Moderate to low river levels resulted in no interruption to normal weir operations this season, and escapements were determined without reliance on passage estimates. Counts from Tatlawiksuk River weir were the earliest escapement data available for Kuskokwim River tributaries in 2004. In each of its 7 years, the project began counting within 5 days of the 15 June target start date.

In 2003 the weir structure failed during a flood. The substrate rail was torn loose from its anchors and was carried several miles downstream along with the weir panels. Additional weir components were constructed over the winter of 2003–2004 to replace those destroyed by the flood. The failure of cable strainers that attached the substrate rail to the duckbill anchors was cited as the most likely cause of the weir malfunction (Linderman et al. 2004). As a result, a sturdier replacement was designed for the 2004 field season. The strainers were replaced with steel brackets that bolted directly to the rail. A 1-1/2 in diameter pipe, welded to the bracket, served as a hitching post for the cable from a duckbill anchor. The cable was wrapped twice around the pipe and fastened to the bracket with a cable clamp. This design does not allow the cable to be tensioned, beyond merely taking out the slack, as the ratcheting strainers did. It does offer a much sturdier connection between the anchors and the rail, which is of primary importance during a flood. Additional measures were taken to prevent another wash out. Larger MR1 manta ray anchors were used to replace every other DB138 duckbill anchor. Also the 5/32 in cable and 1/4 in shackles that were used to connect the anchors to the rail were replaced by 3/16 in cable and 5/16 in shackles. Although the weir never experienced a flood in 2004, we are confident the problems that led to the structural failure in 2003 have been remedied.

FISH PASSAGE AND SALMON ESCAPEMENTS

Determinations of total Chinook, chum, and coho escapements in 2004 are considered accurate representations of annual escapements to the Tatlawiksuk River for 3 reasons. First the location of the weir captured nearly all the salmon spawning habitat in the system (Figure 2). Second, weir counts represented a complete census of daily and total species escapement, with little or no reliance on passage estimation. Third, daily passage trends indicated few salmon passed the weir site before or after the operational period (Table 1).

Chinook Salmon

This year's Chinook salmon escapement was the highest of 6 years observed at Tatlawiksuk River weir (Figure 3; Appendix E1). The overall Kuskokwim River Chinook salmon escapement was considered above average in 2004 (Figure 4; Whitmore et al. *In prep* b). Escapement goals were met or exceeded in all tributaries where they have been established, and the Kuskokwim River Chinook salmon escapement index was the highest on record (Figure 5; Whitmore et al. *In prep* b). Escapements to Kuskokwim River tributaries have improved in recent years from below average levels in 1998–2000 (Bergstrom and Whitmore 2004). Tatlawiksuk River Chinook salmon escapements have followed this overall trend of lows in 1999 and 2000, intermediate levels in subsequent years and a record high escapement in 2004.

Currently no formal escapement goal exists for Tatlawiksuk River Chinook salmon to serve as a benchmark for assessing the adequacy of these escapements. In tributaries where escapement goals have been established (ADF&G 2004) trends have improved since 2000, but to varying degrees. Escapement trends have generally remained within sustainable escapement goal (SEG) ranges at upper Kuskokwim River tributaries, but have increased sharply beyond SEG ranges at lower tributaries (Figure 5; Whitmore et al. *In prep* b). Comparisons suggest escapements of Tatlawiksuk River Chinook salmon have increased to a lesser degree than what has been observed at some lower and middle Kuskokwim River tributaries.

Escapements since 2001 must be considered in respect to recent management actions and market conditions. Kuskokwim River Chinook salmon have been classified as stocks of yield concern by the Alaska Board of Fisheries (BOF) since September 2000 (Burkey et al. 2000 a), and have been managed more conservatively as a result. A subsistence fishing schedule has been implemented annually since 2001. The schedule observes a 3 day weekly closure to allow large pulses of salmon passage through the river, and has likely contributed to higher escapements (Bergstrom and Whitmore 2004). The recent lack of a commercial market for Kuskokwim River chum salmon has also likely influenced Chinook salmon escapements. Surpluses were identified for a chum salmon directed commercial fishery in 2002 and 2003 and went unharvested as a result. Chinook salmon are harvested incidentally with chum salmon in the Kuskokwim River, and most previous years experienced some level of commercial fishing during Chinook salmon run.

In response to adequate run strength indicators for Chinook and chum salmon in 2004, the subsistence schedule was lifted for the season on 20 June, and 4 commercial fishing periods were conducted in the Kuskokwim River between 30 June and 7 July. Additional commercial fishing periods were conducted during the coho salmon run. Only 2,581 Chinook salmon were reported in 2004 commercial salmon harvests compared with a pre-2001 10 year average of 18,081 fish. The impact of the subsistence fishery is likely much greater. An estimate is not yet available for the 2004 subsistence harvest, but the previous 10 year average subsistence Chinook salmon harvest was 81,854 fish (Whitmore et al. *In prep* b).

Run timing for Chinook salmon at Tatlawiksuk River weir was similar in 2004 to previous years with the exception of 1999, which was much later than all other years determined (Figure 6; Appendix E4). The median passage date in 1999 was 18 July, otherwise median passage dates ranged from 4 July in 2002 to 8 July in 2000. The median passage date in 2004 occurred on 5 July. Other Kuskokwim River projects reported Chinook salmon run timing earlier or similar to previous years in 2004 (Costello et al. *In prep*; Roettiger et al. *In prep*; Shelden et al. *In prep*; Stewart and Molyneaux *In prep*; Zabkar et al. *In prep*).

Chum Salmon

The 2004 chum salmon escapement to Tatlawiksuk River is above the average of previous years. Escapements have been determined for chum salmon in 5 of 7 years the project has operated (Figure 3; Appendix E2). The weir was inoperable in 1998 and 2003 due to flood damage and estimates of escapement were not made. Though the 2004 escapement was above average, it fell slightly below escapements in 2001 and 2002. Overall, chum salmon escapements to Kuskokwim River tributaries have recovered from below average levels in 1999 and 2000 to more normal levels in recent years (Bergstrom and Whitmore 2004). Chum salmon escapements to Tatlawiksuk River appear to have followed this overall trend (Figure 7; Whitmore et al. *In prep* b).

A formal escapement goal does not exist to evaluate the adequacy of chum salmon escapements into the Tatlawiksuk River. Escapement goals have been established for chum salmon at Aniak River sonar and Kogrukluk River weir (Figure 8; Whitmore et al. *In prep* b; Molyneaux and Folletti 2005). Comparisons among these projects show common years of low escapement in 1999 and 2000 when goals were not achieved, and significantly higher escapements in subsequent years when goals were achieved or nearly achieved. The 2004 Aniak River sonar count was likely out of proportion with previous years' counts. DIDSON[1] (Dual-frequency Identification Sonar) imaging sonar was newly deployed in 2004, and by allowing technicians to better distinguish fish swimming in close groups, it is believed the DIDSON produced a higher count than technologies in previous years (McEwen 2005). The current chum salmon escapement goal was determined using data produced by older sonar technologies. The unusually high abundance of age-0.2 chum salmon observed in 2004 represent a considerable contribution of escapements to the Aniak and Tatlawiksuk Rivers, but less so to the Kogrukluk River.

Escapements since 2001 must be considered in respect to recent management actions and market conditions. Kuskokwim River chum salmon have been classified as stocks of yield concern by the BOF since September 2000 (Burkey et al. 2000 b), and have been managed more conservatively as a result. A subsistence fishing schedule has been implemented annually since 2001. The schedule observes a 3 day weekly closure to allow large pulses of salmon passage through the river, and has likely contributed to higher escapements (Bergstrom and Whitmore 2004). The recent lack of a commercial market for Kuskokwim River chum salmon has also likely influenced escapements. Surpluses were identified for a chum salmon directed commercial fishery in 2002 and 2003 and went unharvested as a result. Most previous years experienced some level of commercial fishing for chum salmon.

In response to adequate run strength indicators for Chinook and chum salmon in 2004, the subsistence schedule was lifted for the season on 20 June, and 4 commercial fishing periods were conducted in the Kuskokwim River between 30 June and 7 July. Additional commercial fishing periods were conducted during the coho salmon run. Fewer than 23,000 chum salmon were reported in the 2004 commercial harvest. The pre-2001 10 year average commercial chum salmon harvest was 286,134 fish. An estimate is not yet available for the 2004 subsistence harvest, but the previous 10 year average subsistence chum salmon harvest estimate was 61,441 fish (Whitmore et al. *In prep* b).

Chum salmon run timing was similar to previous years at Tatlawiksuk River weir (Figure 6; Appendix E2). Median passage dates have ranged between 10 and 19 July in past years, occurring on 14 July in 2004. Cumulative percent passage was above most other years early in the run, and below most other years late in the run. Other Kuskokwim River projects observed median passage dates earlier or similar to previous years for chum salmon in 2004 (Costello et al. *In prep*; McEwen 2005; Roettiger et al. *In prep*; Shelden et al. *In prep*; Stewart and Molyneaux *In prep*; Zabkar et al. *In prep*).

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[1] Product names used in this report are included for scientific completeness, but do not constitute a product endorsement.

Coho Salmon

The 2004 coho salmon escapement was the highest yet determined at Tatlawiksuk River weir (Figure 3; Appendix E3). Escapements have been determined in 4 of the 7 years the project has operated. The weir was inoperable during portions of the 1998, 2000, and 2003 migration due to flood damage and estimates of coho escapement were not made. Coho salmon escapements are monitored at 5 other weir projects in the Kuskokwim River drainage, and a formal escapement goal exists at Kogrukluk River weir (Figure 9; Whitmore et al. *In prep* b). The escapement goal was achieved and escapements were above most other years at every project except Takotna River weir.

Flood damage at Tatlawiksuk River weir precluded determinations of coho salmon escapements in 1998, 2000, and 2003. Data from the other Kuskokwim River projects provide means for speculation about these escapements (Figure 9). Most notably, all other projects in 2003 reported coho salmon escapements far exceeded previous years observed. This suggests the 2003 escapement to Tatlawiksuk River likely exceeded this year's. Less obvious evidence points to a relationship between abundances in 2004 and those in 2000. Age-2.1 fish were the dominant age class among weir projects in 2004, with proportions estimated between 88% at Kogrukluk River weir, and 98% at Takotna River weir (Costello et al. *In prep*; Roettiger et al. *In prep*; Shelden et al. *In prep*; Stewart and Molyneaux *In prep*; Zabkar et al. *In prep*). Of 4 projects with adequate data between years, 3 projects had escapements in 2004 similar in proportion to those in 2000, the parent year of age-2.1 fish. This suggests a likelihood the Tatlawiksuk River coho salmon escapement in 2000 was similar in abundance to the escapement observed in 2004.

Run timing in 2004 was earlier than previous years before the median passage date on 19 August, and similar to 2001 and 2002 after this date (Figure 6; Appendix E3). The 1999 run was considerably later than all other years observed at Tatlawiksuk River weir. Previous Median passage dates determined were 18 August in 2001, 23 August in 2002, and 2 September in 1999. Run timing at other projects was mixed in comparison with previous years (Costello et al. *In prep*; Roettiger et al. *In prep*; Shelden et al. *In prep*; Stewart and Molyneaux *In prep*; Zabkar et al. *In prep*).

Coho salmon runs to the Kuskokwim River were generally depressed between 1997 and 2002, as indicated by below average commercial harvests concurrent with low escapements in these years (Ward et al. 2003). The run recovered in 2003 with record high escapements and a commercial harvest of 284,064 fish. The commercial harvest had averaged 150,453 fish in the 6 years previous. The 2003 commercial harvest of coho salmon was limited by processor capacity (Whitmore et al. *In prep* a). Market interest increased in 2004, as indicated by this year's commercial harvest of 433,809 fish, an increase of 35% over 2003 (Whitmore et al. *In prep* b).

Other Species

Other salmon species observed historically in the Tatlawiksuk River include small numbers of sockeye and pink salmon (Appendix B1). The Tatlawiksuk River is not a primary spawning tributary for these species; therefore, it is not surprising that few sockeye and no pink salmon were observed in 2004.

Other species commonly observed at Tatlawiksuk River weir include longnose suckers, whitefish, Arctic grayling, and northern pike (Appendix B1). Longnose suckers are historically the most abundant non-salmon species counted at the Tatlawiksuk River weir. The highest recorded passage of this species was 5,093 fish in 1999. However, abundance estimates are incomplete because smaller individuals may be able to pass freely between the pickets, and upstream migration appears to start well before weir operations begin. Only 75 longnose suckers were counted upstream through the weir in 2004, and most of these were observed in the first week of operations in June. Large numbers of longnose suckers were observed migrating downstream along with whitefish species in August and September, suggesting these fish migrated upstream prior to operations in 2004.

Carcass Counts

Approximately 0.3% of the Chinook salmon escapement and 3.3% of chum salmon escapement was later observed as carcasses at the Tatlawiksuk River weir in 2004. These proportions were lower than observed in previous years despite more complete accounting (Appendix C1). The proportion of carcasses to escapement does not account for carcasses washed downstream during inoperable periods and historical proportions are likely higher than reported. Decreasing water levels throughout the 2004 season likely resulted in a lower than historical proportion of carcasses at the weir. The protracted retention of salmon carcasses upstream of the weir in 2004 likely enhanced the absorption of marine derived nutrients, and further contributed to the productivity of the Tatlawiksuk River (Cederholm et al. 1999; 2000). No speculation is made from coho salmon carcass data as the weir was removed likely before the majority of these fish completed spawning.

AGE, SEX, AND LENGTH COMPOSITION

Chinook

ASL data collected from Chinook salmon in 2004 were adequate to describe the composition for total escapement in that sampling occurred throughout the run and total sample size met or exceeded our minimum goal. ASL composition has been estimated for the total Chinook escapement in only 2 of 7 years the project has operated. Flood damage resulting in premature project termination was cited in 2 of those years, and problems collecting the minimum ASL sample size were cited in other years. Increased abundances and improved sampling techniques have resulted in adequate sample collections in 2002 and 2004. An “active sampling” strategy has become an effective means of capturing adequate numbers of Chinook salmon for ASL collection. This strategy entails passing all species through the live trap and capturing Chinook salmon individually or in small groups entering the trap together. Active sampling creates more crew activity around the weir, and Chinook salmon sometimes move back downstream as a result. This behavior is especially evident in low water conditions, and pulse sample collection must sometimes be abbreviated to prevent an abnormal delay in fish passage.

The sex ratio in 2004 remained fairly constant near 33% female throughout the run (e.g. Figure 10; Table 2), with an overall proportion of 32.6% female. This finding was unexpected as male salmon are generally found to migrate earlier than female salmon. Information from 2001 and 2002 indicated the proportion of females increased over the run in those years. In 2004, the proportion of age-1.2 and -1.4 male Chinook salmon decreased over the run, while the proportion of males in the dominant age 1.3 class increased (Figure 11).

Age-1.3 Chinook salmon were the dominant age class in each of the 3 temporal strata collected this season, increasing from 38.7% in the earliest stratum to 57.7% in the latest (Figure 11; Table 2). Age-1.2 fish decreased from 28.6% in the earliest stratum to 11.5% in the latest. Age-1.4 fish remained fairly constant at 32.7%, 33.6%, and 30.8% from earliest to latest stratum.

Total annual proportions between years 2002 and 2004 increased slightly at age 1.2, from 23.2% to 26.5%; increased significantly at age 1.3, from 19.7% to 40.6%; and decreased significantly at age 1.4, from 52.9% to 32.9%.

Data from several Kuskokwim River projects indicated a higher than usual proportion of age-1.2 Chinook salmon in 2004 escapements (Figure 12; Molyneaux and Folletti 2005). These returns contrast with the poor escapements of Chinook salmon observed in the parent year 2000. The high return of age-1.2 Chinook salmon relative to the parent year escapement in 2000 indicates the potential for a strong return of age-1.3 fish in 2005. As nearly all age-1.2 Chinook salmon are male this also had the effect of skewing the sex ratio at many escapement projects.

In 2004, Tatlawiksuk River Chinook salmon exhibited length partitioning by age class for male and female fish. Mean lengths over the 2004 season either increased or remained nearly the same (Figure 13). Comparisons between years indicate mean length of age-1.2 and -1.3 male Chinook salmon stayed fairly consistent throughout the runs, otherwise trends are inconsistent. Mean length in 2004 was greater over all age classes than in 2002, with the largest increases in age 1.4 and 1.2 males. Females were larger than males by age class in both older age classes (Figure 14).

Chum Salmon

The ASL data collected from chum salmon in 2004 were adequate for describing the age composition for the total annual escapement. ASL composition has been estimated in 5 of 7 years the project has operated. Flood damage precluded estimations in 1998 and 2003.

The percentage female past the weir was low in 2004 at 38.7%, in comparison with the range in previous years from 48.2% to 52.6% female (Molyneaux and Folletti 2005). A lower overall proportion of female chum salmon was also observed in the Kwethluk, Tuluksak, Aniak, and Kogrukluk Rivers in 2004 (Molyneaux and Folletti 2005). Age-0.2 and -0.4 chum salmon were higher in abundance and proportion to escapement in 2004 than all previous years observed (Figure 8; Molyneaux and Folletti 2005). Record high abundances of age-0.2 fish were observed in all monitored tributaries in 2004 (Molyneaux and Folletti 2005). This coupled with the above average escapement in 2001 indicates the potential for a strong return of age-0.3 chum salmon in 2005.

Length partitioning occurs between sex and age class at Tatlawiksuk River weir (Figure 14). Mean lengths were shorter overall in 2004 than previous years observed, except for age 0.2 males which increased slightly from 2002 (Figure 15). This trend was also observed over comparable years in the Kwethluk, George, Kogrukluk, and Takotna Rivers (Molyneaux and Folletti 2005).

Trends in ASL composition over the 2004 season followed overall trends for chum salmon observed in previous years at Tatlawiksuk River weir. Seasonal trends revealed the ratio of female salmon increased as the run progressed in 2004 (Figure 10). Age became younger (Figure 16) and mean length shorter (Figure 15) over the run. Mean lengths increased with age, and males tended to be longer than females at Tatlawiksuk weir.

Coho Salmon

The ASL data collected from coho salmon in 2004 were adequate for describing the age composition for the total annual escapement. ASL composition has been estimated in 4 of 7 years the project has operated. Flood damage precluded estimations in 1998, 2000, and 2003.

Comparisons between years indicate the second highest female ratio observed in 2004 at 50.6%, with ratios ranging from 38.7% in 2002, to 52.1% in 2001 (Molyneaux and Folletti 2005). The proportion of age-2.1 coho salmon was the highest yet recorded in 2004, at 94.4% of escapement (Table 6). Estimates of age-2.1 fish previously ranged from 79.1% of escapement in 1999, to 91.2% of escapement in 2001. Length partitioning does not appear to occur between sexes in age-2.1 fish, and mean length of this age class was shorter in 2004 than previously observed at Tatlawiksuk River weir (Figure 14). Mean lengths were shorter in 2004 as compared with 2002, 2001, and 1999, at all other weirs in the Kuskokwim River drainage (Molyneaux and Folletti 2005).

Trends in ASL composition over the 2004 season followed overall trends for coho salmon observed in previous years at Tatlawiksuk River weir. Seasonal trends indicate the ratio of female fish tends to increase slightly over the run (Figure 10). Age composition remains fairly consistent (Figure 17), and mean length increases only slightly (Figure 18), over the season for coho salmon at Tatlawiksuk River weir.

HABITAT VARIABLES

Migration in salmon is controlled by genetic factors as an adaptation to long-term average environmental conditions (Quinn 2005). Keefer et al. (2004) found a positive correlation between river discharge and run timing of Columbia River Chinook salmon stocks. Columbia River sockeye salmon have started their inriver migration 2 weeks earlier in response to warmer water conditions resulting from dam construction. Knowledge of environmental conditions and a commitment to long-term monitoring may be valuable in understanding migration and survival. The weir crew maintained a relatively complete record of the habitat variables collected during the 2004 season. These measurements can easily be neglected in field camps, and may seem a low priority among project objectives. Incorporating weather and stream observations into the daily morning and afternoon radio schedules with ADF&G staff in Bethel helps insure the data are gathered consistently throughout the season.

Historical data indicate generally warmer water temperatures in 2004 above all previous years observed, except 2000 (Figures 19–21). Stream height data indicates lower water levels (discharge) in 2004 relative to previous years during the Chinook and chum salmon runs, and were considerably lower than all other years observed during the coho salmon run (Figures 22–24). Any relationship between stream temperature and passage strength or timing (Appendix E4) is not easily discernable by the available data. The effect of migration timing does change in relation to long term changes in freshwater water temperatures (Quinn 2005). The relation of water level to fish passage is less well understood and varies among sites and species (Quinn 2005).

CHINOOK SALMON RADIOTELEMETRY

The primary objective of the radiotelemetry project was to estimate inriver abundance of Chinook salmon in the Kuskokwim River, upstream of the tagging site near Lower Kalskag. Findings in 2004 will be discussed by Stuby (2005). The study was designed to incorporate escapement data from various projects including Tatlawiksuk River weir, to estimate inriver abundance. Tatlawiksuk River weir successfully provided these data in 2004.

The radiotelemetry data offered an opportunity to study migration characteristics of Tatlawiksuk River Chinook salmon in 2004. A total of 5 radio-tagged Chinook salmon were detected migrating past the weir in 2004 (Figure 25; L. Stuby, Sport Fish Biologist, ADF&G, Fairbanks;

personal communication). The distance between the tagging site and the weir was 198 river miles. The transit time, from tagging to initial detection at the weir, ranged from 9.2 to 16.4 days, and averaged 11.8 days. Additional time elapsed between the initial detection by the receiver station at the weir and passage through the weir for each fish. This additional time averaged 4.5 days and ranged from 1.0 to 8.0 days. This is in contrast to the average period of delay measured at Kogrukluk and George River weirs of 0.8 days and 1.4 days respectively (L. Stuby, Sport Fish Biologist, ADF&G, Fairbanks; personal communication). The longer period of delayed passage at Tatlawiksuk River weir is not yet understood. This difference may be due to environmental differences among rivers or the lower relative abundance, requiring longer ASL sampling sessions that may affect behavior of Chinook salmon around the weir. Project staff and crew must continue to examine sampling techniques in an effort to minimize possible delays in passage.

Preliminary data from Stuby (2003, 2004, 2005) indicates the run timing of discreet Chinook salmon spawning aggregates past the Lower Kalskag tagging site in 2004 (Figure 26; L. Stuby, Sport Fish Biologist, ADF&G, Fairbanks; personal communication). The pattern of upper river populations running past the tagging site earlier than lower river populations was more distinct in 2004 than in 2003, when timing was more compacted. The run timing pattern in 2004 was more consistent with the pattern indicated in 2002 than in 2003.

CHUM AND COHO SALMON TAG RECOVERY

Tag recovery efforts were successful throughout the 2004 season salmon run at Tatlawiksuk River weir. Operations at Tatlawiksuk River weir were uninterrupted between 15 June and 18 September, and tag detection was considered complete during this period. All passage was successfully conducted through the live trap despite very low water conditions, enabling crew to recover 42 of 46 tags observed. Occasionally tagged salmon escaped upstream before they could be captured in the live trap, resulting in missed tag recoveries (i.e. recording of the unique tag number). The recovery of tag numbers offered an opportunity to study migration characteristics of Tatlawiksuk River chum and coho salmon in 2004.

Chum Salmon

The distribution of tags detected relative to passage at the weir indicates the latter half of the Tatlawiksuk River chum run was not well represented in the tagging sample (Figure 25; Pawluk et al. *In prep*). Recovered tag numbers indicate the distribution of tagged Tatlawiksuk River chum salmon relative to the total chum salmon catch at the tagging site near Lower Kalskag (Figure 27; Pawluk et al. *In prep*). The reduced catch rate seen in early July may account for the low proportion of tagged fish in the latter half of the chum salmon run at the weir. The lack of Tatlawiksuk River chum salmon tagged during and after the peak catch period suggests the majority had already passed the tagging site, and were a relatively early component of the overall tagged sample. Tag recoveries from other Kuskokwim River escapement projects suggest a difference in run timing between spawning populations as they pass the tagging site near Lower Kalskag (Figure 28; Pawluk et al. *In prep*). These findings are similar to previous years and further suggest that Tatlawiksuk River chum salmon migrate past this area during the early portion of the mainstem chum salmon run (Figure 28; Kerkvliet et al. 2003; 2004).

Transit time, between tagging and passage at the weir, ranged from 8 to 11 days and averaged 9 days in 2004. This is similar to the 8 day average transit time observed for chum salmon in 2002 (Kerkvliet et al. 2003; Pawluk et al. *In prep*).

Coho Salmon

The distribution of tags detected relative to passage at the weir indicates either the early portion of the Tatlawiksuk River coho run was missed in the tagging sample, or transit time was somewhat longer for tagged fish than non tagged fish (Figure 25; Pawluk et al. *In prep*). Recovered tag numbers from Tatlawiksuk River coho salmon indicate these samples were distributed mostly throughout the early and middle portion of the coho salmon catch at the tagging site near Lower Kalskag (Figure 27; Pawluk et al. *In prep*). Tag recoveries from other Kuskokwim River escapement projects in 2004 suggest a difference in run timing between spawning populations as they pass the tagging site near Lower Kalskag (Figure 29; Pawluk et al. *In prep*). These findings are similar to previous years and suggest that Tatlawiksuk River coho salmon migrate past this area during the early portion of the mainstem coho salmon run (Figure 29; Kerkvliet et al. 2003; 2004).

Transit time, between tagging and passage at the weir, ranged from 12 to 37 days and averaged 19 days in 2004. This is considerably longer than the 14 day average transit time observed for coho salmon in 2002 (Kerkvliet et al. 2003; Pawluk et al. *In prep*). This could be a factor of the very low stream flow conditions in 2004 that may have prolonged the coho salmon run at Tatlawiksuk River weir (Figure 24).

CONCLUSIONS

Chinook and coho salmon escapements were higher in 2004 than in previous years determined at Tatlawiksuk River weir. This was similar to what occurred at most other escapement projects in the Kuskokwim River drainage.

The Tatlawiksuk River chum salmon escapement in 2004 fell below levels observed in 2001 and 2002, but was considerably higher than levels observed in 1999 and 2000, which were the parent years of the two dominant age classes.

The high return of age-1.2 Chinook salmon relative to the parent year escapement in 2000 indicates the potential for a strong return of age-1.3 fish in 2005.

Unusually high returns of age-0.2 chum salmon in 2004 along with above average escapement in 2001, indicate a high potential for a strong return of age-0.3 chum salmon in 2004.

Information recovered from fish tagged in the mainstem Kuskokwim River suggest Tatlawiksuk River salmon are likely an early component of runs migrating past the tagging site, located near the village of Kalskag.

RECOMMENDATIONS

PROJECT OPERATION

- Annual operation of the Tatlawiksuk River weir should continue indefinitely. Although the weir malfunction caused the project to terminate prematurely in 2003, the weir was successfully improved and operated in 2004. Tatlawiksuk River weir project has been a valuable addition to the array of well-distributed escapement monitoring projects throughout the Kuskokwim River drainage. Adequate monitoring of Kuskokwim River salmon escapements is one of many requirements needed for long-term sustainable management of Kuskokwim River salmon stocks. Discontinuation of the Tatlawiksuk River weir, or any other escapement monitoring project, would be a step backward from progress made in recent years toward collecting salmon stock assessment and information needs in the Kuskokwim River drainage. Additionally, the Tatlawiksuk River weir project serves as one of several data collection platforms critical to other Kuskokwim River salmon research projects. *Inriver Abundance of Chinook Salmon in the Kuskokwim River* project (FIS #05-302) is critically dependent on data collected from these weirs to generate total river abundance estimates. *Kuskokwim River salmon mark–recapture project* (FIS #04-308) uses weir-recaptured spaghetti tagged chum, sockeye, and coho salmon to develop and test total river abundance estimates, and these recaptures are critical for determining stock-specific run timing in the mainstem Kuskokwim River. Tatlawiksuk River is part of the genetic stock identification (GSI) baseline for Chinook, chum, and coho salmon, and plans are underway to use the weir for additional sample collection. In 2005 samples will be collected at Tatlawiksuk River weir for *Genetic Stock Identification of Chinook Salmon on the Kuskokwim River* (FIS #05-305).

- Establish escapement goals for Tatlawiksuk River Chinook, chum, and coho salmon. ADF&G should continue seeking to establish biological escapement goals (BEG) to produce maximum sustainable yield (MSY) for these species at the Tatlawiksuk River, and in other Kuskokwim River spawning tributaries; however, determining MSY requires a rigorous level of stock specific spawner-recruit information still lacking. Alternatively, sustainable escapement goals (SEG) can be established, but require a 5 to 10 year data series of reliable escapement estimates that demonstrate sustainable yields. Recent deliberations on establishing escapement goals at the Tatlawiksuk River and other Kuskokwim River tributaries resulted in inaction because of inadequate historical escapement information (ADF&G 2004), heightening the need for uninterrupted continuation of the project.

PROJECT MANAGEMENT

- The Tatlawiksuk River weir should continue to be operated jointly by KNA and ADF&G. The partnership developed between KNA and ADF&G in the operation of fisheries projects, including the Tatlawiksuk River weir, has proven to be a successful strategy. Each organization compliments the partnership by providing an element the other cannot.

  KNA provides a communication link to help its constituents be more informed and less prone to the distrust and misinformation that can result when local organizations and their constituents are not directly involved. Active involvement of KNA adds an element of trust and acceptance toward the projects and ADF&G, which would not exist if ADF&G operated these projects alone. KNA is more effective at hiring technicians for these projects from the local area, and makes these jobs more acceptable and accessible for potential applicants. Additionally, the proximity of KNA facilities to these cooperatively managed projects provides logistical benefits for staging and for responding to various inseason project needs.

  Despite these attributes, KNA would have difficulty managing the Tatlawiksuk River weir and other jointly operated fisheries projects without ADF&G involvement. The fisheries staff of ADF&G has a greater depth of experience in fisheries project management; both in terms of on-site field experience, and broader aspects such as planning, data management and analysis, and report writing. The addition of a Partners Fisheries Biologist to the KNA staff has shifted some of these responsibilities to KNA, evident with the inclusion of David Cannon as a co-author of this report in 2003 and 2004. However, addition of one fisheries biologist to the KNA staff has not replaced all ADF&G personnel involved and the many years of fisheries management experience, scientific expertise, and understanding they contribute. Additionally, KNA's fisheries biologist has a myriad of other responsibilities, and is involved with multiple projects and with multiple cooperative partners. This time limit reduces the direct attention KNA's biologist can contribute to individual project requirements.

Partnership between KNA and ADF&G is a major contributing factor to success of the many fisheries projects for which these organizations are responsible. Dissolution of this partnership would result in a detrimental loss of continuity and support to both inseason and postseason project requirements, and increases the possibility of misunderstanding and mistrust between ADF&G, KNA, and the public. Continued joint operation will help to ensure the success of these projects in the future.

AGE, SEX, AND LENGTH DATA

- Sample size objectives for ASL sampling of Chinook salmon should be re-evaluated and possibly changed to be more reflective of the actual run sizes encountered in the Tatlawiksuk River. Under current methods, the crew is expected to annually collect 630 Chinook salmon; i.e., 3 pulses each consisting of 210 fish. The total annual Chinook run in the Tatlawiksuk River, however, has only ranged from 817 to 2,733 fish. The current ASL sampling size objectives are designed for larger populations and may not be appropriate for the Tatlawiksuk River population.

HABITAT MONITORING

- Install a water temperature data logger in the river channel to enable the determination of high, low, and mean daily measurements. This would provide more complete temperature documentation and enable better comparisons between years.
- Purchase basic surveying equipment including an optical level, tripod, and leveling rod to enable accurate translation of the stream height gauge to a more distant and permanent benchmark, such as a mark on a healthy tree located a safe distance from the unstable river banks.
- Conduct additional stream discharge surveys to reestablish a link between flows and a new, more permanent benchmark. Several stream discharge surveys were conducted in previous years at Tatlawiksuk River weir, but these were never linked to a viable permanent benchmark.

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Many individuals contributed to the operation of the Tatlawiksuk River weir in 2004. Thanks to David Cannon, Dwayne Hoffman, Samantha John, Tamara Kvamme, and Karrina Wooderson of KNA who assisted with administrative needs and logistical support. Our greatest appreciation goes to crew members Billy Alexie, Russell Corona, and college intern Peter Kaiser, who did the bulk of the inseason work. David Orabutt, Derrick Williams, Jerad Vanderpool, and Kris Maledy worked tirelessly to repair, install, and remove the weir before and after the season.

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REFERENCES CITED

Alaska Department of Fish and Game (ADF&G). 1998. An atlas to the catalog of water important for spawning, rearing or migration of anadromous fishes. Region VI: Interior region resource management. Alaska Department of Fish and Game, Habitat and Restoration Division, Anchorage.

Alaska Department of Fish and Game (ADF&G). 2004. Escapement goal review of select AYK Region salmon stocks. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Informational Report 3A04-01, Anchorage.

Bergstrom, D. J. and C. Whitmore. 2004. Kuskokwim River Chinook and chum salmon stock status and action plan, a report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Informational Report 3A04-02, Anchorage.

Brannian, L. K., S. Darr, H. A. Krenz, S. StClair, and C. Lawn. 2005. Development of the Arctic-Yukon-Kuskokwim salmon database management system through June 30, 2005. Alaska Department of Fish and Game, Special Publication No. 05-10, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/sp05-10.pdf

Bromaghin, J. F. 1993. Sample size determination for interval estimation of multinomial probabilities. The American Statistician. 47(3): 203-206.

Brown, C. M. 1983(draft). Alaska's Kuskokwim River region: a history. Bureau of Land Management, Anchorage.

Buklis, L. S. 1999. A description of economic changes in commercial salmon fisheries in a region of mixed subsistence and market economies. Arctic. 52 (1): 40-48.

Burkey, C., Jr. and P. Salomone. 1999. Kuskokwim Area salmon escapement observation catalog, 1984-1998. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A99-11, Anchorage.

Burkey, C. Jr., M. Coffing, D. B. Molyneaux and P. Salomone. 2000 a. Kuskokwim River chinook salmon stock status and development of management / action plan options, report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A00-40, Anchorage.

Burkey, C. Jr., M. Coffing, D. B. Molyneaux and P. Salomone. 2000 b. Kuskokwim River chum salmon stock status and development of management / action plan options, report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A00-41, Anchorage.

Cederholm, C. J., M. D. Kunze, T. Murota and A. Sibatani. 1999. Pacific salmon carcasses: essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24(10): 6-15.

Cederholm, C. J., D. H. Johnson, R. E. Bilby, L. G. Dominguez, A. M. Garrett, W. H. Graeber, E. L. Greda, M. D. Kunze, B. G. Marcot, J. F. Palmisano, W. G. Pearcy, C. A. Simenstad, and P. C. Trotter. 2000. Pacific salmon and wildlife–ecological contexts, relationships, and implications for management. Special Edition Technical Report, Prepared for D.H. Johnson and T.A. O'Neil (Mang. Dirs.). Wildlife-Habitat Relationships in Oregon and Washington. Washington Department of Fish and Wildlife, Olympia.

Coffing, M. 1991. Kwethluk subsistence: contemporary land use patterns, wild resource harvest and use, and the subsistence economy of a lower Kuskokwim River area community. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 157, Juneau.

Coffing, M. *Unpublished* a. Kuskokwim area subsistence salmon harvest summary, 1996; prepared for the Alaska Board of Fisheries, Fairbanks, Alaska, December 2, 1997. Alaska Department of Fish and Game, Division of Subsistence, Bethel.

Coffing, M. *Unpublished* b. Kuskokwim area subsistence salmon fishery; prepared for the Alaska Board of Fisheries, Fairbanks, Alaska, December 2, 1997. Alaska Department of Fish and Game, Division of Subsistence, Bethel.

Coffing, M., L. Brown, G. Jennings and C. Utermohle. 2000. The subsistence harvest and use of wild resources in Akiachak, Alaska, 1998. Alaska Department of Fish and Game, Division of Subsistence, Final Project Report to U.S. Fish and Wildlife Service, Office of Subsistence Management, FIS 00-009, Juneau.

Costello, D. J., S. E. Gilk, and D. B. Molyneaux. *In prep.* Takotna River Salmon Studies and Upper Kuskokwim River Aerial Surveys, 2004. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Crane, P., D. Molyneaux, S. Miller, K. Harper, and J. Wenburg. *In prep*. Genetic variation among coho salmon populations from the Kuskokwim River region and application to stock-specific harvest estimation. U.S. Fish and Wildlife Service, Office of Subsistence Management, Fisheries Resource Monitoring Program, Annual Report for Study 04-311, Anchorage, Alaska.

DuBois, L. and D. B. Molyneaux. 2000. Salmon age, sex, and length catalog for the Kuskokwim Area, 1999 Progress Report. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A00-18, Anchorage.

Estensen, J. L. 2002. Middle Fork Goodnews River Fisheries Studies, 2000 - 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A02-31, Anchorage.

Gilk, S. E. and D. B. Molyneaux. 2004. Takotna River salmon studies and upper Kuskokwim River aerial surveys, 2003. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A04-23, Anchorage.

Groot, C. and L. Margolis (Eds.). 1991. Pacific Salmon Life Histories. Department of Fisheries and Oceans, Biological Sciences Branch, Canada. UBC Press, Vancouver, British Columbia.

Hauer, F. R. and W. R. Hill. 1996. Temperature, light and oxygen. Pages 93-106 in F. R. Hauer and G. A. Lambert (Eds.) Methods in Stream Ecology. Academic Press, San Diego.

Holmes, R. A. and R. D. Burtkett. 1996. Salmon stewardship: Alaska's perspective. Fisheries 21 (10): 36-38.

INPFC (International North Pacific Fisheries Commission). 1963. Annual report, 1961. International North Pacific Fisheries Commission Vancouver, British Columbia.

Keefer, M. L., C. A. Peery, M. A. Jepson, K. R. Tolotti, and T. C. Bjornn. 2004. Stock-specific migration timing of adult spring-summer Chinook salmon in the Columbia River basin. North American Journal of Fisheries Management 24:1145-1162.

Kerkvliet, C. M., T. Hamazaki, K. E. Hyer, and D. Cannon. 2003. A mark–recapture experiment to estimate the abundance of Kuskokwim River chum, sockeye, and coho salmon, 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A03-25, Anchorage.

Kerkvliet, C. M., J. Pawluk, T. Hamazaki, K. E. Hyer, and D. Cannon. 2004. A mark–recapture experiment to estimate the abundance of Kuskokwim River chum, sockeye and coho salmon, 2003. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A04-14, Anchorage.

Kruse, G. H. 1998. Salmon run failures in 1997-1998: a link to anomalous ocean conditions? Alaska Fishery Research Bulletin 5 (1): 55-63.

Linderman, J. C. Jr., D. B. Molyneaux, L. DuBois and W. Morgan. 2002. Tatlawiksuk River weir salmon studies, 1998–2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A02-11, Anchorage.

Linderman, J. C. Jr., D. J. Cannon, and D. B. Molyneaux. 2003. Tatlawiksuk River weir salmon studies, 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A03-16, Anchorage.

Linderman, J. C. Jr., D. B. Molyneaux, D. L. Folletti, and D. J. Cannon. 2004. Tatlawiksuk River weir salmon studies, 2003. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A04-16, Anchorage.

McEwen, M. S. 2005. Sonar estimation of chum salmon passage in the Aniak River, 2004. Alaska Department of Fish and Game, Fishery Data Series No. 05-30, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/Fds05-30.pdf

D. B. Molyneaux and D. L. Folletti. 2005. Salmon age, sex, and length catalog for the Kuskokwim Area, 2004. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A05-03, Anchorage.

Mundy, P. R. 1998. Principles and criteria for sustainable salmon management, a contribution to the development of a salmon fishery evaluation framework for the State of Alaska. Alaska Department of Fish and Game, Contract No. IHP-98-045, Anchorage.

NRC (National Research Council). 1996. Upstream: salmon and society in the Pacific Northwest, Committee on the Protection and Management of Pacific Northwest Salmonids. National Academy Press, Washington, D.C.

Pawluk, J., T. Hamazaki, K. E. Hyer, and D. Cannon. *In prep*. Kuskokwim River sockeye, chum, and coho salmon tagging study, 2004. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Quinn, T. P. 2005. The behavior and ecology of Pacific salmon and trout. University of Washington Press, Seattle.

Roettiger, T., F. G. Harris, and K. C. Harper. 2004. Abundance and run timing of adult Pacific salmon in the Kwethluk River, Yukon Delta National Wildlife Refuge, Alaska, 2003. U.S. Fish and Wildlife Service, Kenai Fish and Wildlife Field Office. Alaska Fisheries Data Series No. 2004-8, Kenai, Alaska.

Roettiger, T., F. G. Harris, and K. C. Harper. *In prep*. Abundance and run timing of adult Pacific salmon in the Kwethluk River, Yukon Delta National Wildlife Refuge, Alaska, 2004. U.S. Fish and Wildlife Service, Kenai Fish and Wildlife Field Office. Alaska Fisheries Data Series, Kenai, Alaska.

Schneiderhan, D. J. *Unpublished*. Kuskokwim stream catalog, 1954-1983. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

Shelden, C. W., S. E Gilk, and D. B. Molyneaux. 2004. Kogrukluk River weir salmon studies, 2003. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A04-22, Anchorage.

Shelden, C. A., D. J. Costello, and D. B. Molyneaux. *In prep*. Kogrukluk River weir salmon studies, 2004. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Stewart, R. 2002. Resistance board weir panel construction manual, 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A02-21, Anchorage.

Stewart, R. 2003. Techniques for installing a resistance board fish weir. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A03-26, Anchorage.

Stewart, R. and D. B. Molyneaux. *In prep*. George River salmon studies, 2004. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Stroka, S. M., and A. L. J. Brase. 2004. Assessment of Chinook, chum, and coho salmon escapements in the Holitna River drainage using radiotelemetry, 2001–2003. Final Report for Study 01-141 USFWS Office of Subsistence Management Fisheries Information Services Division. Alaska Department of Fish and Game, Fishery Data Series No. 04-07, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds04-07.pdf

Stuby, L. 2003. Inriver abundance of chinook salmon in the Kuskokwim River, 2002. Annual Report for Study 02-015, USFWS Office of Subsistence Management, Fishery Information Service Division. Alaska Department of Fish and Game, Fishery Data Series No. 03-22, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds03-22.pdf

Stuby, L. 2004. Inriver abundance of Chinook salmon in the Kuskokwim River, 2003. Alaska Department of Fish and Game, Fishery Data Series No. 04-30, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds04-30.pdf

Stuby, L. 2005. Inriver abundance of Chinook salmon in the Kuskokwim River, 2002-2004. Alaska Department of Fish and Game, Fishery Data Series No. 05-39, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/Fds05-39.pdf

Tobin, J. H. 1994. Construction and performance of a portable resistance board weir for counting migrating adult salmon in rivers. U.S. Fish and Wildlife Service, Kenai Fishery Resource Office, Alaska Fisheries Technical Report Number 22, Kenai, Alaska.

Ward, T. C. Jr., M. Coffing, J. L. Estensen, R. L. Fisher, and D. B. Molyneaux. 2003. Annual management report for the subsistence and commercial fisheries of the Kuskokwim Area, 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A03-27, Anchorage.

Whitmore, C., M. Martz, D. G. Bue and J. C. Linderman. *In prep* a. Annual management report for the subsistence and commercial fisheries of the Kuskokwim Area, 2003. Alaska Department of Fish and Game, Fishery Management Report, Anchorage.

Whitmore, C., M. Martz, D. G. Bue and J. C. Linderman. *In prep* b. Annual management report for the subsistence and commercial fisheries of the Kuskokwim Area, 2004. Alaska Department of Fish and Game, Fishery Management Report, Anchorage.

Williams, J. G. 2000. Alaska population overview, 1999 estimates. Alaska Department of Labor and Workforce Development, Research and Analysis Section, pgs. 146–149.

Zabkar, L. M. and K. C. Harper. 2004. Abundance and run timing of adult Pacific salmon in the Tuluksak River, Yukon Delta National Wildlife Refuge, Alaska, 2003. U.S. Fish and Wildlife Service, Kenai Fish and Wildlife Field Office. Alaska Fisheries Data Series No. 2004-6, Kenai, Alaska.

Zabkar, L. M., F. G. Harris, and K. C. Harper. *In prep*. Abundance and run timing of adult Pacific salmon in the Tuluksak River, Yukon Delta National Wildlife Refuge, Alaska, 2004. U.S. Fish and Wildlife Service, Kenai Fish and Wildlife Field Office. Alaska Fisheries Data Series, Kenai, Alaska.

TABLES AND FIGURES

Table 1.–Daily, daily cumulative, and daily cumulative percent passage for Chinook, chum, and coho salmon at Tatlawiksuk River weir, 2004.

	Chinook Salmon			Chum Salmon			Coho Salmon		
Date	**Daily**	**Cumulative**	**%**	**Daily**	**Cumulative**	**%**	**Daily**	**Cumulative**	**%**
06/15	2	2	0	9	9	0	0	0	0
06/16	2	4	0	15	24	0	0	0	0
06/17	0	4	0	7	31	0	0	0	0
06/18	4	8	0	22	53	0	0	0	0
06/19	8	16	1	75	128	1	0	0	0
06/20	3	19	1	105	233	1	0	0	0
06/21	2	21	1	53	286	1	0	0	0
06/22	1	22	1	81	367	2	0	0	0
06/23	0	22	1	71	438	2	0	0	0
06/24	11	33	1	169	607	3	0	0	0
06/25	74	107	4	594	1,201	6	0	0	0
06/26	241	348	12	450	1,651	8	0	0	0
06/27	21	369	13	175	1,826	9	0	0	0
06/28	84	453	16	176	2,002	9	0	0	0
06/29	75	528	19	266	2,268	11	0	0	0
06/30	43	571	20	378	2,646	12	0	0	0
070/1	315	886	31	462	3,108	15	0	0	0
07/02	131	1,017	36	690	3,798	18	0	0	0
07/03	86	1,103	39	660	4,458	21	0	0	0
07/04	165	1,268	45	525	4,983	23	0	0	0
07/05	243	1,511	53	482	5,465	26	0	0	0
07/06	7	1,518	54	235	5,700	27	0	0	0
07/07	84	1,602	57	638	6,338	30	0	0	0
07/08	106	1,708	60	811	7,149	34	0	0	0
07/09	229	1,937	68	836	7,985	38	0	0	0
07/10	165	2,102	74	627	8,612	41	0	0	0
07/11	43	2,145	76	425	9,037	43	0	0	0
07/12	16	2,161	76	502	9,539	45	0	0	0
07/13	98	2,259	80	967	10,506	49	0	0	0
07/14	29	2,288	81	759	11,265	53	0	0	0
07/15	31	2,319	82	642	11,907	56	0	0	0
07/16	47	2,366	84	829	12,736	60	0	0	0
07/17	161	2,527	89	863	13,599	64	0	0	0
07/18	53	2,580	91	800	14,399	68	0	0	0
07/19	17	2,597	92	655	15,054	71	0	0	0
07/20	12	2,609	92	573	15,627	74	1	1	0
07/21	22	2,631	93	557	16,184	76	0	1	0
07/22	21	2,652	94	495	16,679	79	3	4	0
07/23	26	2,678	95	513	17,192	81	6	10	0
07/24	19	2,697	95	463	17,655	83	7	17	0
07/25	13	2,710	96	474	18,129	85	3	20	0
07/26	14	2,724	96	359	18,488	87	19	39	0
07/27	26	2,750	97	421	18,909	89	31	70	0
07/28	19	2,769	98	344	19,253	91	22	92	1
07/29	9	2,778	98	304	19,557	92	18	110	1
07/30	2	2,780	98	123	19,680	93	15	125	1
07/31	15	2,795	99	322	20,002	94	106	231	1
08/01	0	2,795	99	151	20,153	95	55	286	2

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Table 1.–Page 2 of 2.

	Chinook Salmon			Chum Salmon			Coho Salmon		
Date	Daily	Cumulative	%	Daily	Cumulative	%	Daily	Cumulative	%
08/02	1	2,796	99	124	20,277	95	93	379	2
08/03	2	2,798	99	85	20,362	96	98	477	3
08/04	4	2,802	99	93	20,455	96	128	605	4
08/05	6	2,808	99	117	20,572	97	214	819	5
08/06	5	2,813	99	87	20,659	97	452	1,271	8
08/07	3	2,816	99	99	20,758	98	468	1,739	11
08/08	4	2,820	100	134	20,892	98	437	2,176	13
08/09	0	2,820	100	43	20,935	99	497	2,673	16
08/10	2	2,822	100	44	20,979	99	536	3,209	20
08/11	3	2,825	100	45	21,024	99	450	3,659	22
08/12	0	2,825	100	26	21,050	99	722	4,381	27
08/13	1	2,826	100	13	21,063	99	534	4,915	30
08/14	0	2,826	100	22	21,085	99	646	5,561	34
08/15	0	2,826	100	19	21,104	99	628	6,189	38
08/16	1	2,827	100	14	21,118	99	515	6,704	41
08/17	0	2,827	100	7	21,125	99	575	7,279	44
08/18	0	2,827	100	5	21,130	99	591	7,870	48
08/19	0	2,827	100	14	21,144	100	716	8,586	52
08/20	0	2,827	100	20	21,164	100	395	8,981	55
08/21	3	2,830	100	9	21,173	100	708	9,689	59
08/22	0	2,830	100	12	21,185	100	825	10,514	64
08/23	1	2,831	100	9	21,194	100	679	11,193	68
08/24	0	2,831	100	4	21,198	100	473	11,666	71
08/25	0	2,831	100	7	21,205	100	638	12,304	75
08/26	0	2,831	100	5	21,210	100	266	12,570	77
08/27	0	2,831	100	4	21,214	100	304	12,874	78
08/28	0	2,831	100	3	21,217	100	259	13,133	80
08/29	1	2,832	100	3	21,220	100	246	13,379	82
08/30	0	2,832	100	0	21,220	100	238	13,617	83
08/31	0	2,832	100	1	21,221	100	284	13,901	85
09/01	0	2,832	100	6	21,227	100	507	14,408	88
09/02	1	2,833	100	0	21,227	100	260	14,668	89
09/03	0	2,833	100	2	21,229	100	281	14,949	91
09/04	0	2,833	100	2	21,231	100	183	15,132	92
09/05	0	2,833	100	1	21,232	100	88	15,220	93
09/06	0	2,833	100	2	21,234	100	137	15,357	94
09/07	0	2,833	100	3	21,237	100	117	15,474	94
09/08	0	2,833	100	0	21,237	100	134	15,608	95
09/09	0	2,833	100	0	21,237	100	119	15,727	96
09/10	0	2,833	100	0	21,237	100	123	15,850	97
09/11	0	2,833	100	2	21,239	100	149	15,999	97
09/12	0	2,833	100	1	21,240	100	95	16,094	98
09/13	0	2,833	100	1	21,241	100	114	16,208	99
09/14	0	2,833	100	1	21,242	100	85	16,293	99
09/15	0	2,833	100	2	21,244	100	68	16,361	100
09/16	0	2,833	100	1	21,245	100	19	16,380	100
09/17	0	2,833	100	0	21,245	100	23	16,403	100
09/18	0	2,833	100	0	21,245	100	7	16,410	100
09/19	0 [a]	2,833	100	0 [a]	21,245	100	0 [a]	16,410	100
09/20	0 [a]	2,833	100	0 [a]	21,245	100	0 [a]	16,410	100

Note: The boxes represent the median passage date and central 50% of the run.

[a] Weir was not operational, daily passage estimated.

Table 2.–Estimated age and sex composition of the Chinook salmon escapement at the Tatlawiksuk River weir, 2004.

			Age 1.2		Age 1.3		Age 1.4		Total	
Sample and (Stratum) Dates	Sample Size	Sex	Number of Fish	%	Number of Fish	%	Number of Fish	%	Number of Fish	%
6/21-22, 28-30		M	423	28.0	468	31.0	135	8.9	1,025	67.9
(6/15 - 7/5)		F	9	0.6	117	7.7	360	23.8	486	32.1
	168	Subtotal	432	28.6	585	38.7	495	32.7	1,511	100.0
7/6-8, 12-16		M	290	27.1	310	29.0	120	11.2	719	67.3
(7/6-7/18)		F	0	0.0	110	10.3	240	22.4	350	32.7
	107	Subtotal	290	27.1	420	39.3	360	33.6	1,069	100.0
7/19-20, 28, 8/3-5		M	29	11.5	117	46.2	20	7.7	165	65.4
(7/19-9/18)		F	0	0.0	29	11.5	58	23.1	88	34.6
	26	Subtotal	29	11.5	146	57.7	78	30.8	253	100.0
Season		M	742	26.2	894	31.6	274	9.7	1,910	67.4
		F	9	0.3	256	9.0	658	23.2	923	32.6
	301	Total	751	26.5	1,150	40.6	932	32.9	2,833	100.0

Table 3.–Estimated mean length (mm) of the Chinook salmon escapement at Tatlawiksuk River weir, 2004.

Sample and (Stratum) Dates	Sex		Age Class 1.2	1.3	1.4
6/21-22, 28-30	M	Mean Length	591	694	783
(6/15-7/5)		Std. Error	7	7	19
		Range	460- 753	599- 853	662- 950
		Sample Size	47	52	15
	F	Mean Length	578	724	818
		Std. Error	-	10	12
		Range	587-587	676- 802	686- 940
		Sample Size	1	13	40
7/6-8, 12-16	M	Mean Length	594	718	853
(7/6-7/18)		Std. Error	9	8	29
		Range	507- 698	660- 850	708-1010
		Sample Size	29	31	12
	F	Mean Length		712	824
		Std. Error		14	14
		Range		662- 789	701- 980
		Sample Size	0	11	24
7/19-20, 28, 8/3-5	M	Mean Length	586	709	895
(7/19-9/18)		Std. Error	21	17	65
		Range	565-627	615- 822	830- 960
		Sample Size	3	12	2
	F	Mean Length		802	851
		Std. Error		30	10
		Range		743- 834	835- 900
		Sample Size	0	3	6
Season	M	Mean Length	592	704	821
		Range	460- 753	599- 853	662-1010
		Sample Size	79	95	29
	F	Mean Length	587	728	823
		Range	587-587	662- 834	686- 980
		Sample Size	1	27	70

Table 4.–Estimated age and sex composition of the chum salmon escapement at the Tatlawiksuk River weir, 2004.

Sample and (Stratum) Dates	Sample Size	Sex	Age 0.2 Number of Fish	Age 0.2 %	Age 0.3 Number of Fish	Age 0.3 %	Age 0.4 Number of Fish	Age 0.4 %	Age 0.5 Number of Fish	Age 0.5 %	Total Number of Fish	Total %
6/21-23		M	0	0.0	242	14.7	946	57.3	0	0.0	1,188	72.0
(6/15-26)		F	0	0.0	116	7.0	337	20.4	11	0.6	463	28.0
	157	Subtotal	0	0.0	358	21.7	1,283	77.7	11	0.6	1,651	100.0
6/28-30		M	0	0.0	600	21.4	1,314	46.8	16	0.6	1,931	68.8
(6/27-7/3)		F	6	0.6	406	14.4	438	15.6	16	0.6	876	31.2
	173	Subtotal	16	0.6	1,006	35.8	1,752	62.4	32	1.2	2,807	100.0
7/6-8		M	248	6.0	1,045	25.2	1,458	35.1	0	0.0	2,751	66.2
(7/4-10)		F	110	2.6	798	19.2	495	11.9	0	0.0	1,403	33.8
	151	Subtotal	358	8.6	1,843	44.4	1,953	47.0	0	0.0	4,154	100.0
7/12-14		M	196	4.8	1,025	24.9	1,178	28.6	0	0.0	2,400	58.2
(7/11-16)		F	240	5.8	1,004	24.3	480	11.6	0	0.0	1,724	41.8
	189	Subtotal	436	10.6	2,029	49.2	1,658	40.2	0	0.0	4,124	100.0
7/17, 19-21		M	642	13.1	1,108	22.5	1,197	24.3	0	0.0	2,947	59.9
(7/17-24)		F	377	7.6	1,130	23.0	465	9.5	0	0.0	1,972	40.1
	222	Subtotal	1,019	20.7	2,238	45.5	1,662	33.8	0	0.0	4,919	100.0
7/26-28		M	409	17.4	385	16.4	361	15.4	0	0.0	1,155	49.2
(7/25-31)		F	361	15.4	614	26.2	217	9.2	0	0.0	1,192	50.8
	195	Subtotal	770	32.8	999	42.6	578	24.6	0	0.0	2,347	100.0
8/2-5, 9		M	234	18.8	217	17.4	194	15.6	0	0.0	645	51.9
(8/1-9/18)		F	276	22.2	252	20.3	70	5.6	0	0.0	598	48.1
	212	Subtotal	510	41.0	469	37.7	264	21.2	0	0.0	1,243	100.0
Season		M	1,730	8.1	4,623	21.8	6,648	31.3	16	0.1	13,018	61.3
		F	1,380	6.5	4,319	20.3	2,502	11.8	27	0.1	8,227	38.7
	1,299	Total	3,110	14.6	8,942	42.1	9,150	43.1	43	0.2	21,245	100.0

Table 5.–Estimated mean length (mm) of the chum salmon escapement at Tatlawiksuk River weir, 2004.

Sample and (Stratum) Dates	Sex		Age Class 0.2	0.3	0.4	0.5
6/21-23	M	Mean Length		577	599	
(6/15-26)		Std. Error		5	3	
		Range		528-610	504-663	
		Sample Size	0	23	90	0
	F	Mean Length		552	575	578
		Std. Error		7	4	-
		Range		509-597	519-638	578-578
		Sample Size	0	11	32	1
6/28-30	M	Mean Length		580	596	593
(6/27-7/3)		Std. Error		5	3	-
		Range		500-632	534-658	593-593
		Sample Size	0	37	81	1
	F	Mean Length	585	559	564	553
		Std. Error	-	5	5	-
		Range	585-585	524-614	529-612	553-553
		Sample Size	1	25	27	1
7/6-8	M	Mean Length	552	577	594	
(7/4-10)		Std. Error	6	4	4	
		Range	526-583	512-632	520-664	
		Sample Size	9	38	53	0
	F	Mean Length	574	550	559	
		Std. Error	5	5	3	
		Range	560-583	494-602	539-583	
		Sample Size	4	29	18	0
7/12-14	M	Mean Length	544	573	590	
(7/11-16)		Std. Error	6	4	4	
		Range	525-571	524-652	513-648	
		Sample Size	9	47	54	0
	F	Mean Length	511	544	562	
		Std. Error	8	4	5	
		Range	452-545	504- 626	517-622	
		Sample Size	11	46	22	0

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Table 5.–Page 2 of 2.

Sample and (Stratum) Dates	Sex		Age Class 0.2	0.3	0.4	0.5
7/17, 19-21	M	Mean Length	546	568	599	
(7/17-24)		Std. Error	6	4	5	
		Range	450-598	514-623	509-682	
		Sample Size	29	50	54	0
	F	Mean Length	517	545	556	
		Std. Error	5	3	6	
		Range	475-548	494-608	491-608	
		Sample Size	17	51	21	0
7/26-28	M	Mean Length	540	556	588	
(7/25-31)		Std. Error	3	5	6	
		Range	500-598	484-621	520-654	
		Sample Size	34	32	30	0
	F	Mean Length	522	533	555	
		Std. Error	5	3	6	
		Range	468-590	480-604	512-595	
		Sample Size	30	51	18	0
8/2-5, 9	M	Mean Length	526	552	583	
(8/1-9/18)		Std. Error	3	6	5	
		Range	484-560	486-632	509-643	
		Sample Size	40	37	33	0
	F	Mean Length	501	530	531	
		Std. Error	5	5	14	
		Range	403-568	403-639	402-594	
		Sample Size	47	43	12	0
Season	M	Mean Length	543	572	595	593
		Range	450-598	484-652	504-682	593-593
		Sample Size	121	264	395	1
	F	Mean Length	519	544	561	563
		Range	403-590	403-639	402-638	553-578
		Sample Size	110	256	150	2

Table 6.–Estimated age and sex composition of the coho salmon escapement at Tatlawiksuk River weir, 2004.

			Age 1.1		Age 2.1		Age 3.1		Total	
Sample and (Stratum) Dates	**Sample Size**	**Sex**	**Number of Fish**	**%**	**Number of Fish**	**%**	**Number of Fish**	**%**	**Number of Fish**	**%**
7/26-27, 8/2-5		M	0	0	874	50.3	29	1.6	903	51.9
(7/20-8/7)		F	0	0	817	47.0	19	1.1	836	48.1
	183	Subtotal	0	0	1,691	97.3	48	2.7	1,739	100.0
8/9		M	84	1.7	2,609	52.5	84	1.7	2,777	55.9
(8/8-16)		F	0	0	2,188	44.1	0	0	2,188	44.1
	59	Subtotal	84	1.7	4,797	96.6	84	1.7	4,965	100.0
8/23		M	101	1.6	2,427	39.3	0	0	2,529	41.0
(8/17-27)		F	202	3.3	3,338	54.1	101	1.6	3,641	59.0
	61	Subtotal	303	4.9	5,765	93.4	101	1.6	6,170	100.0
9/2-3		M	61	1.7	1,768	50.0	61	1.7	1,890	53.4
(8/28-9/18)		F	61	1.7	1,463	41.4	122	3.5	1,646	46.6
	58	Subtotal	122	3.4	3,231	91.4	183	5.2	3,536	100.0
Season		M	247	1.5	7,679	46.8	174	1.0	8,098	49.4
		F	263	1.6	7,806	47.6	242	1.5	8,312	50.6
	361	Total	510	3.1	15,485	94.4	416	2.5	16,410	100.0

Table 7.–Estimated mean length (mm) of the coho salmon escapement at Tatlawiksuk River weir, 2004.

Sample and (Stratum) Dates	Sex		Age Class 1.1	2.1	3.1
7/26-27, 8/2-5	M	Mean Length		536	585
(7/20-8/7)		Std. Error		4	19
		Range		385-595	549-612
		Sample Size	0	92	3
	F	Mean Length		531	563
		Std. Error		3	1
		Range		408-574	562-564
		Sample Size	0	86	2
8/9	M	Mean Length	518	550	484
(8/8-16)		Std. Error	-	6	-
		Range	518-518	467-612	484-484
		Sample Size	1	31	1
	F	Mean Length		550	
		Std. Error		5	
		Range		506- 592	
		Sample Size	0	26	0
8/23	M	Mean Length	505	536	
(8/17-27)		Std. Error	-	11	
		Range	505-505	415-598	
		Sample Size	1	24	0
	F	Mean Length	481	543	532
		Std. Error	7	5	-
		Range	474-488	478-594	532-532
		Sample Size	2	33	1
9/2-3	M	Mean Length	536	557	534
(8/28-9/18)		Std. Error	-	6	-
		Range	536-536	495-623	534-534
		Sample Size	1	29	1
	F	Mean Length	547	549	537
		Std. Error	-	5	33
		Range	547-547	480-613	504-570
		Sample Size	1	24	2
Season	M	Mean Length	517	546	518
		Range	505-536	385-623	484-612
		Sample Size	3	176	5
	F	Mean Length	496	545	537
		Range	474-547	408-613	504-570
		Sample Size	3	169	5

Figure 1.–Kuskokwim Management Area.

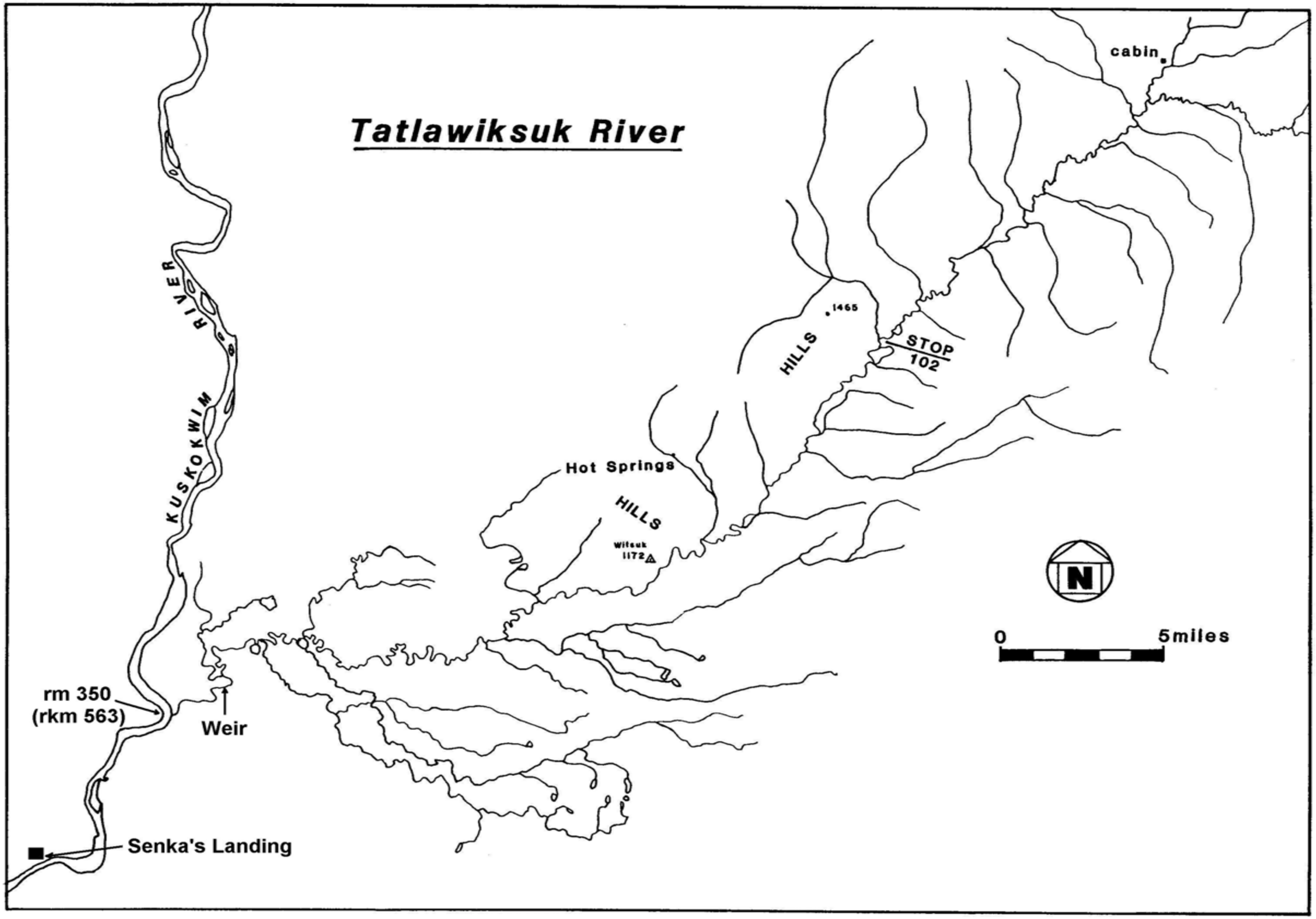
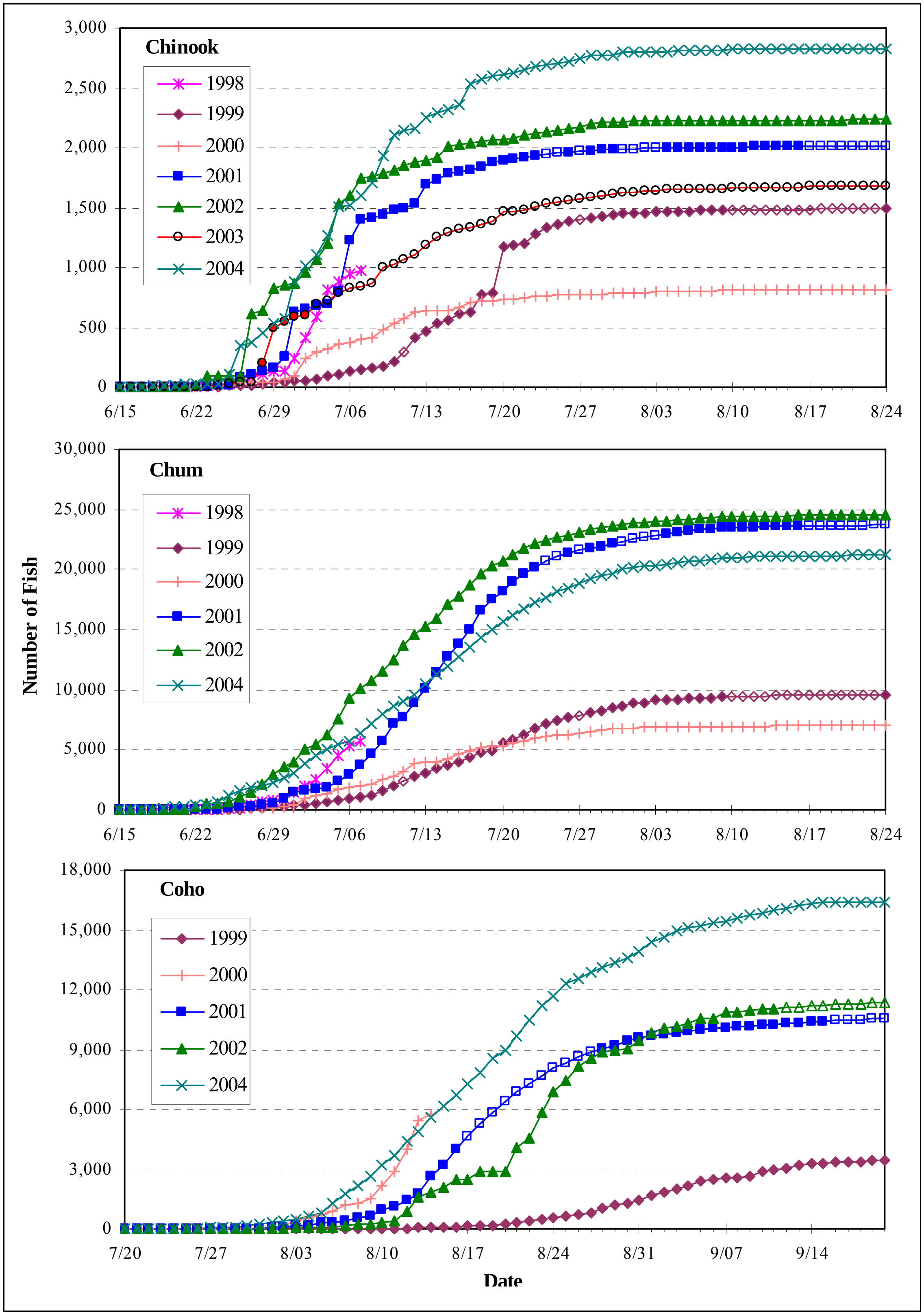


Figure 2.–Tatlawiksuk River, middle Kuskokwim River basin.



Note: Solid symbols represent observed passage, open symbols represent estimated passage.

Figure 3.–Historical intra-annual cumulative passage of Chinook, chum, and coho salmon at the Tatlawiksuk River weir.

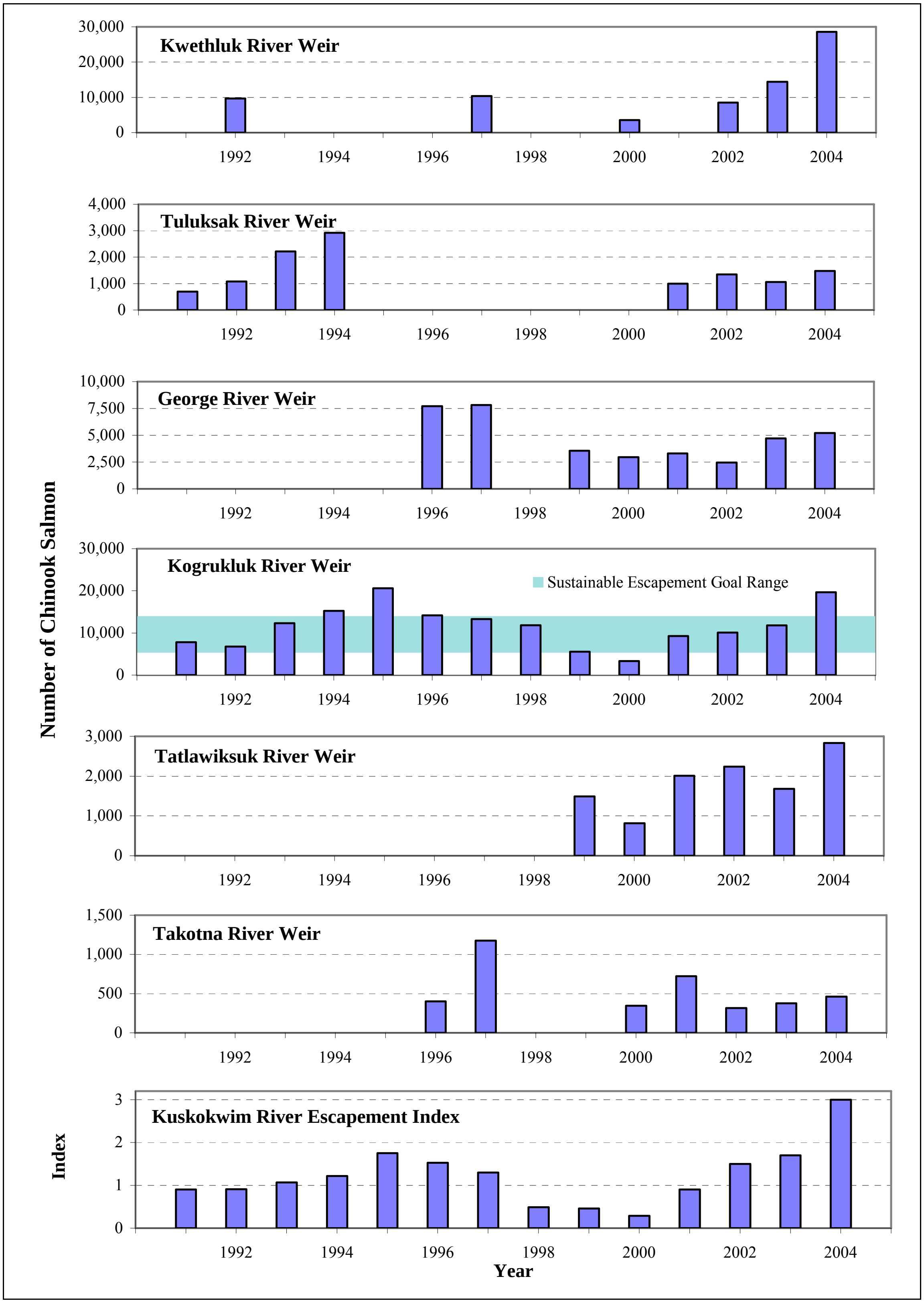
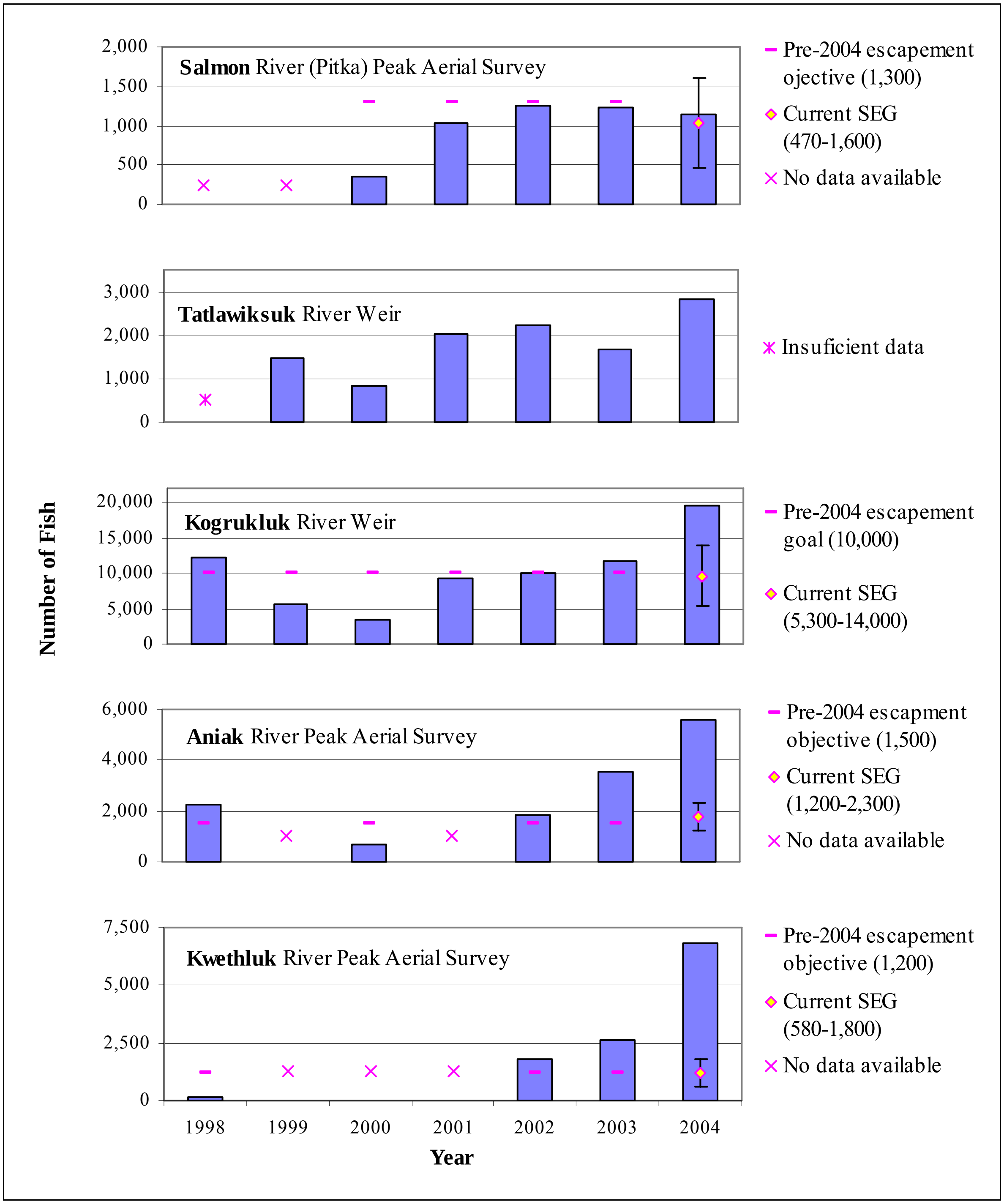
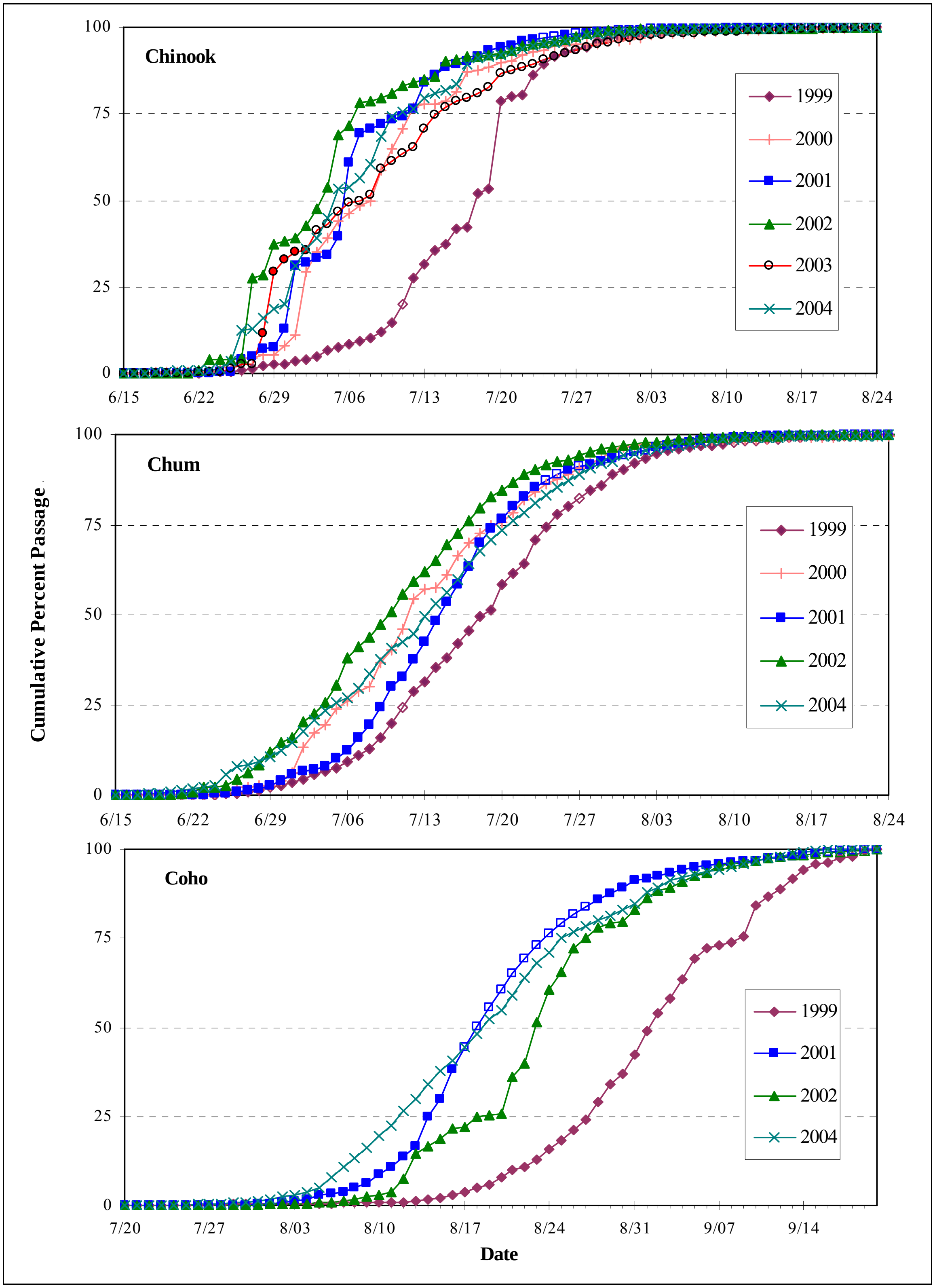


Figure 4.–Historical Chinook salmon escapement into 6 Kuskokwim River tributaries, and the Kuskokwim River Chinook salmon escapement index, 1991–2004.



Note: Data sets are arranged geographically, with upper Kuskokwim River tributaries at the top and lower Kuskokwim River tributaries at the bottom. Aerial survey data represent a single escapement count over an index area during a "peak" survey period, between 20 and 31 July for Chinook salmon, when the maximum number of fish is expected to be on the spawning grounds. In 2004 Kuskokwim Area escapement goals and objectives were revised to establish sustainable escapement goals (SEGs) that describe ranges set to produce runs and harvests similar to what has occurred in the past.

Figure 5.–Historical Chinook salmon escapement data for Tatlawiksuk River weir and select Kuskokwim River tributaries with escapement goals.



Note: Solid symbols represent observed passage, open symbols represent estimated passage.

Figure 6.–Historical intra-annual percent passage of Chinook, chum, and coho salmon at the Tatlawiksuk River weir.

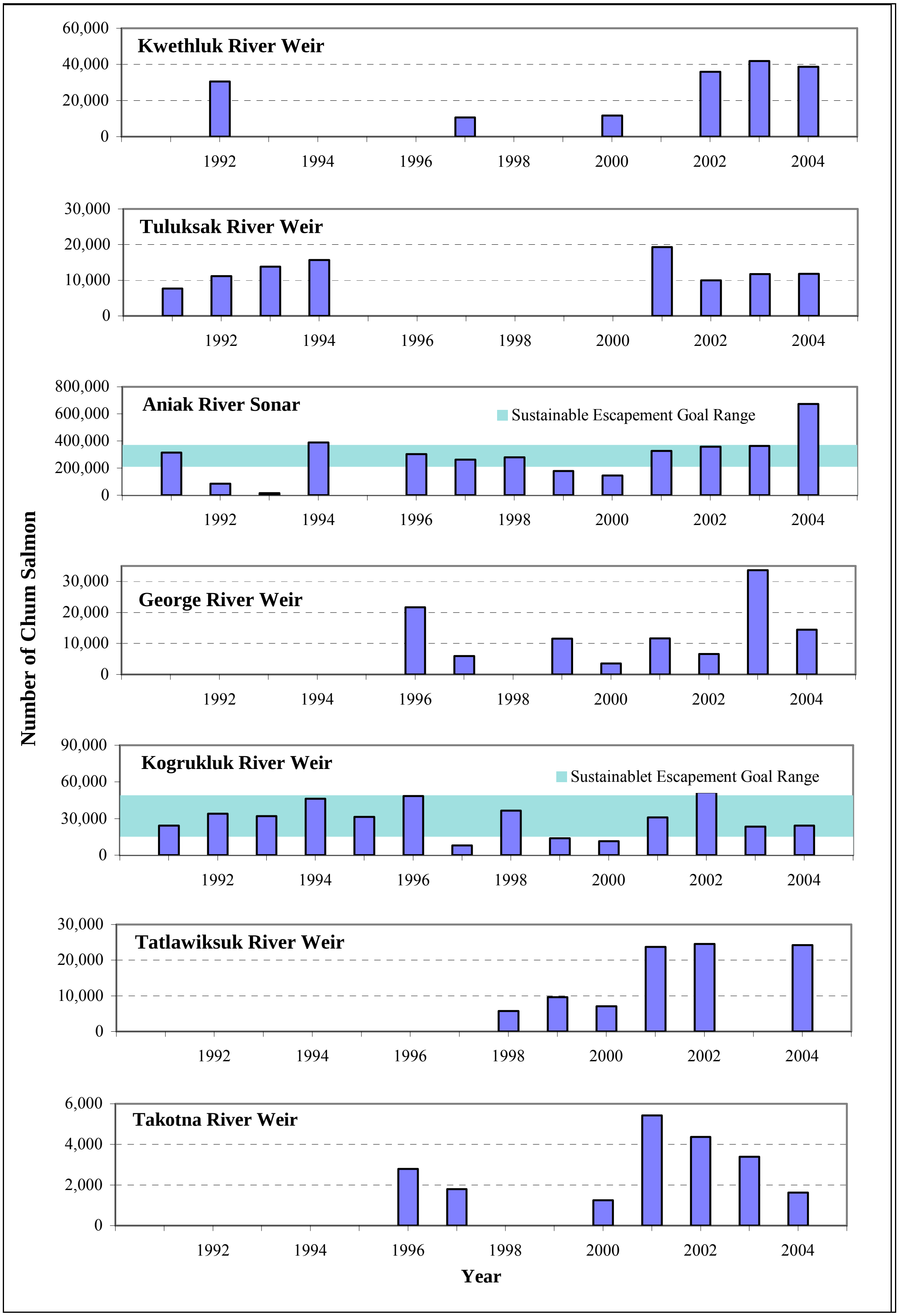
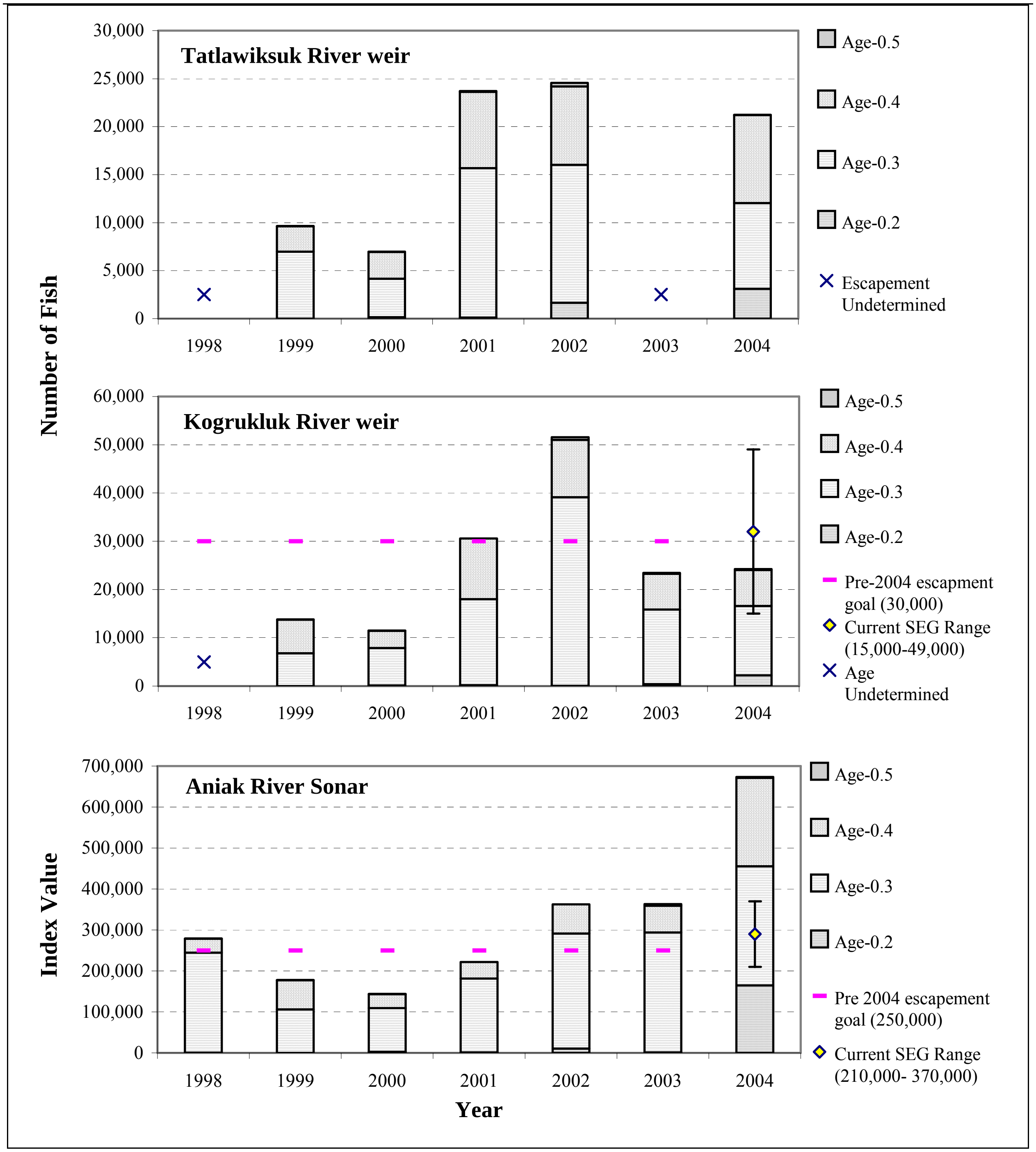


Figure 7.–Historical annual chum salmon escapement into 7 Kuskokwim River tributaries, 1991–2004.



Note: In 2004 Kuskokwim Area escapement goals and objectives were revised to establish sustainable escapement goals (SEGs) that describe ranges set to produce runs and harvests similar to what has occurred in the past.

Figure 8.–Historical chum salmon escapement data by age class for Tatlawiksuk River weir and other Kuskokwim River tributaries with escapement goals.

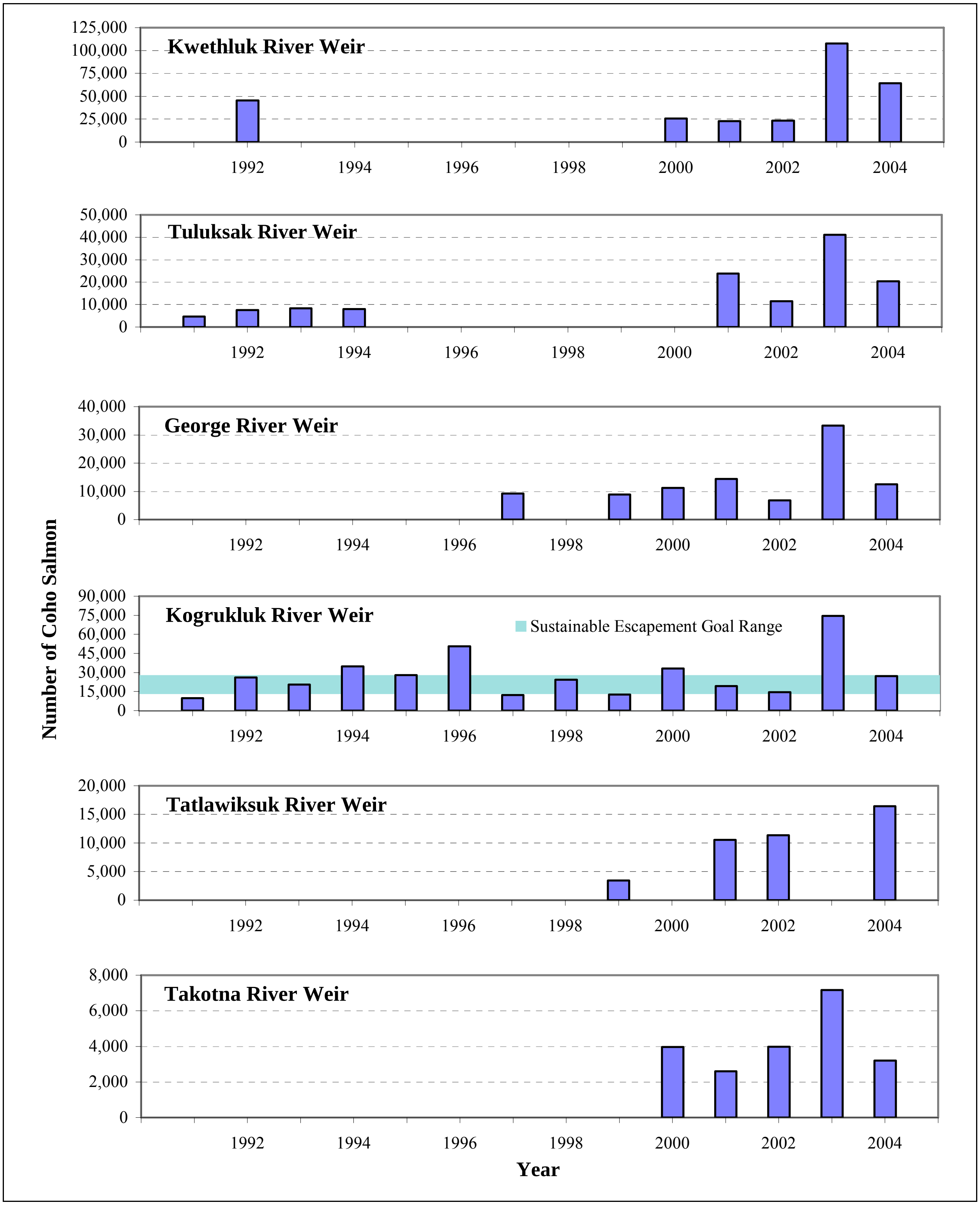


Figure 9.–Historical annual coho salmon escapement into 6 Kuskokwim River tributaries, 1991–2004.

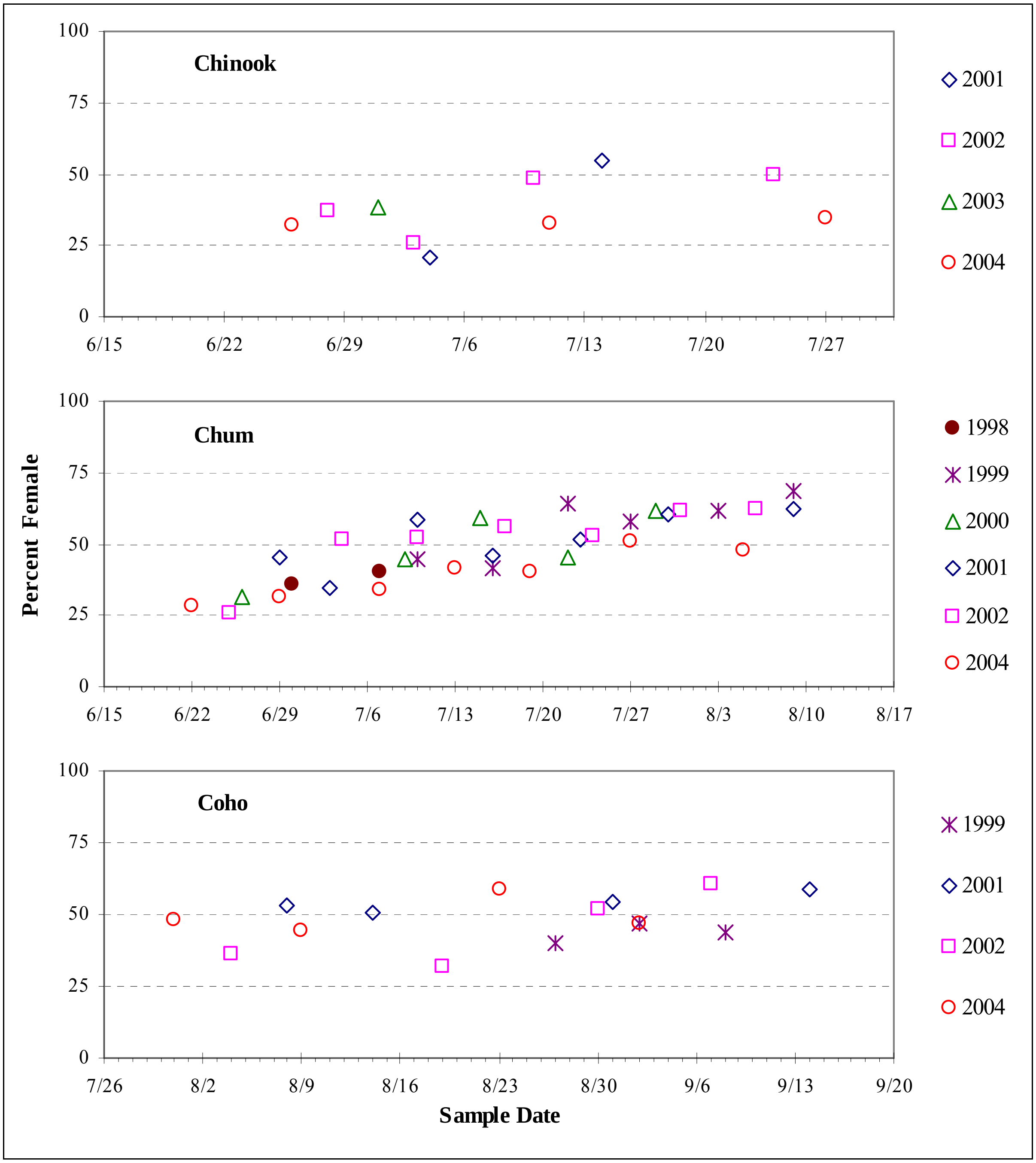


Figure 10.–Historical intra-annual percent female Chinook, chum, and coho salmon at the Tatlawiksuk River weir by sample date.

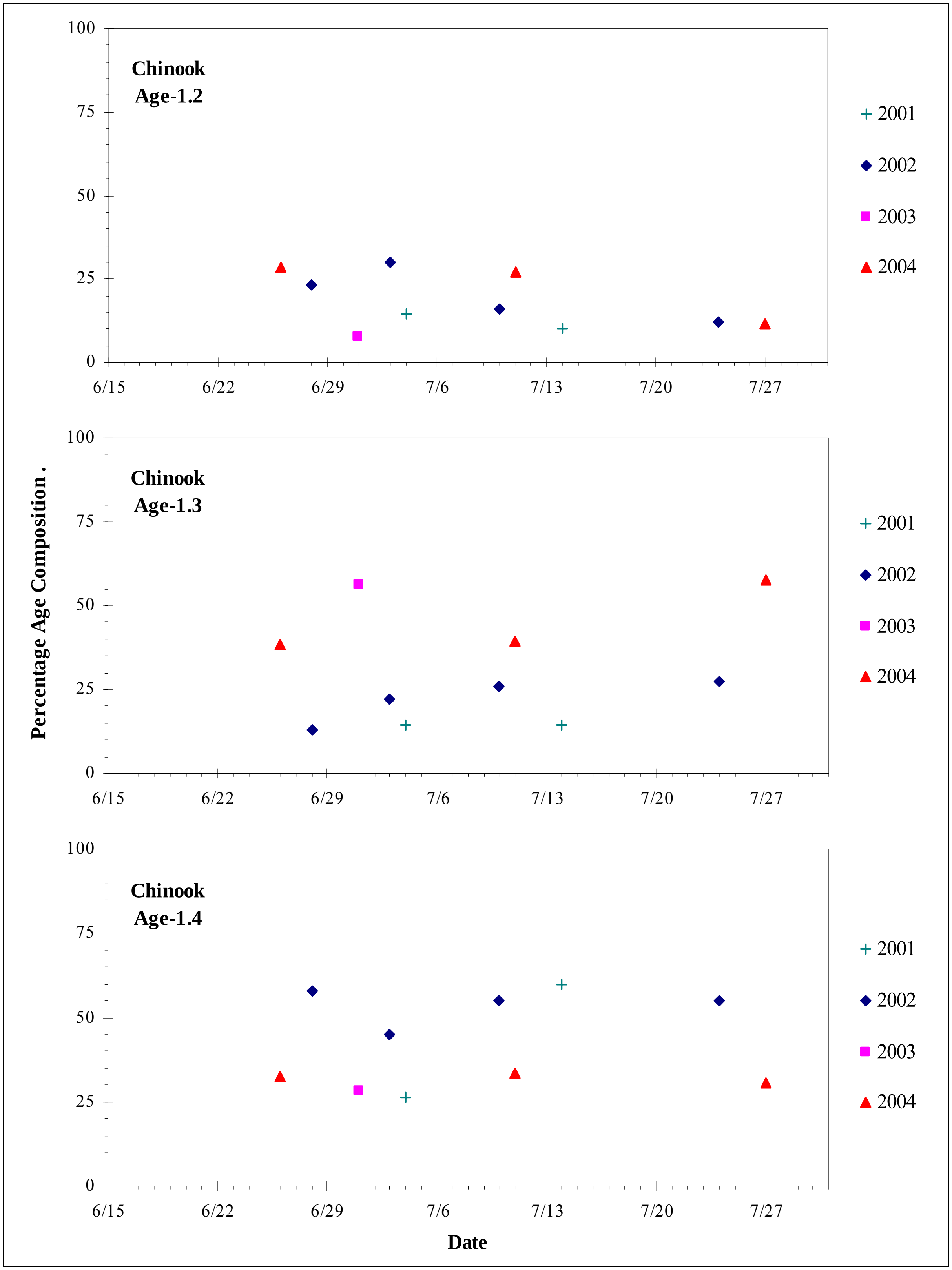


Figure 11.–Historical intra-annual age composition of Chinook salmon at the Tatlawiksuk River weir by sample date.

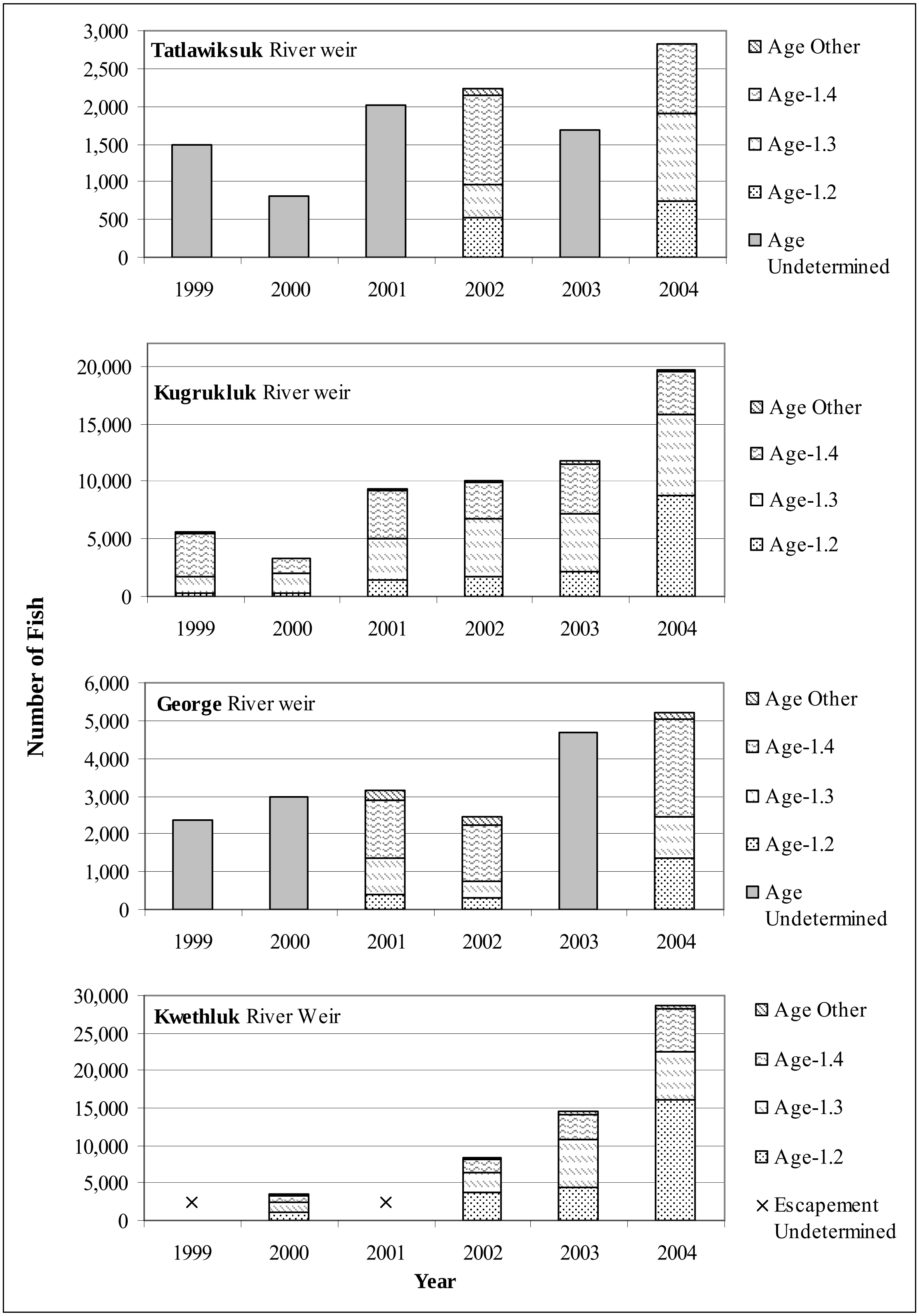


Figure 12.–Age composition relative to escapement of Chinook salmon at 4 Kuskokwim River tributary projects, 1999–2004.

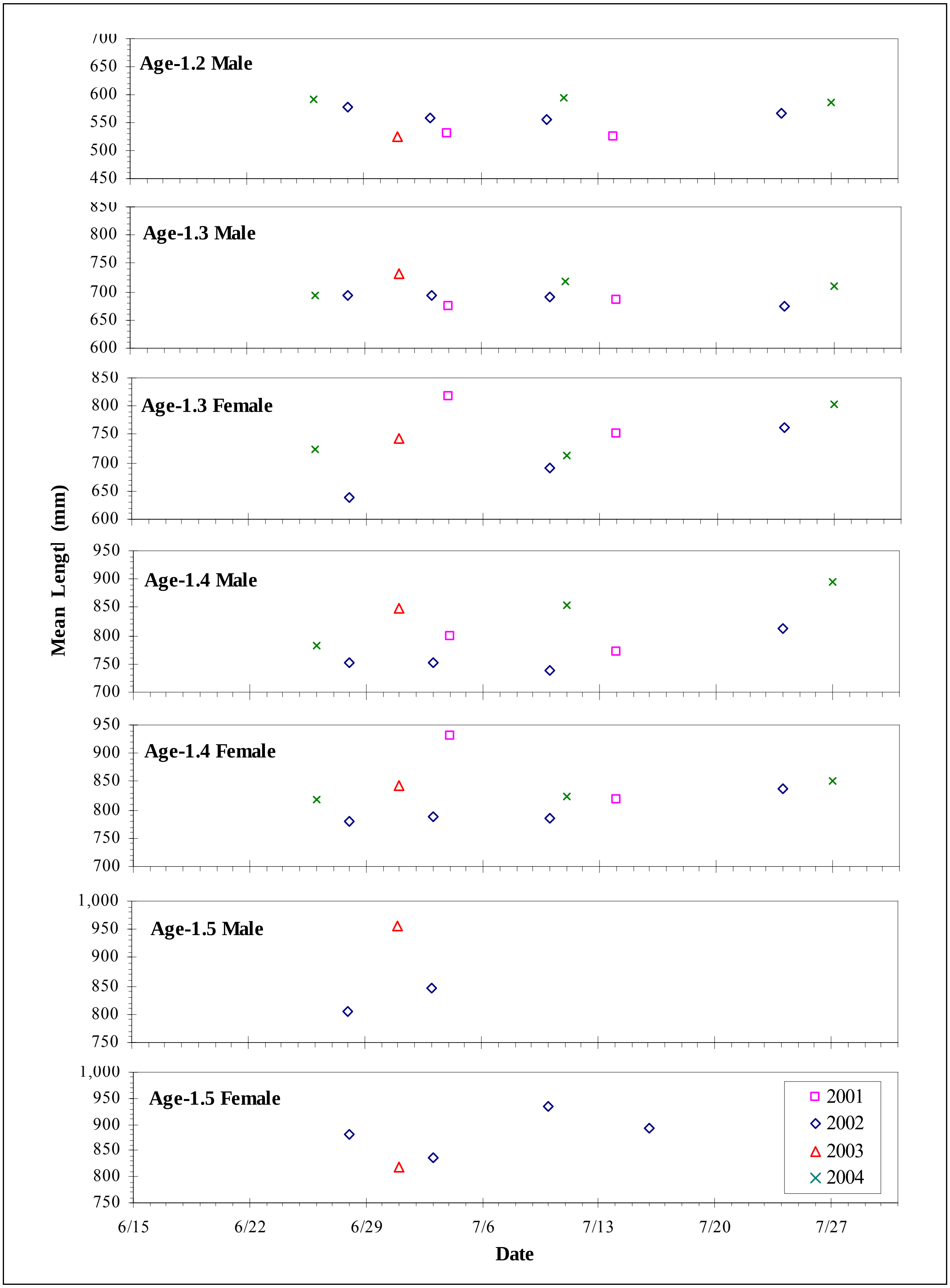
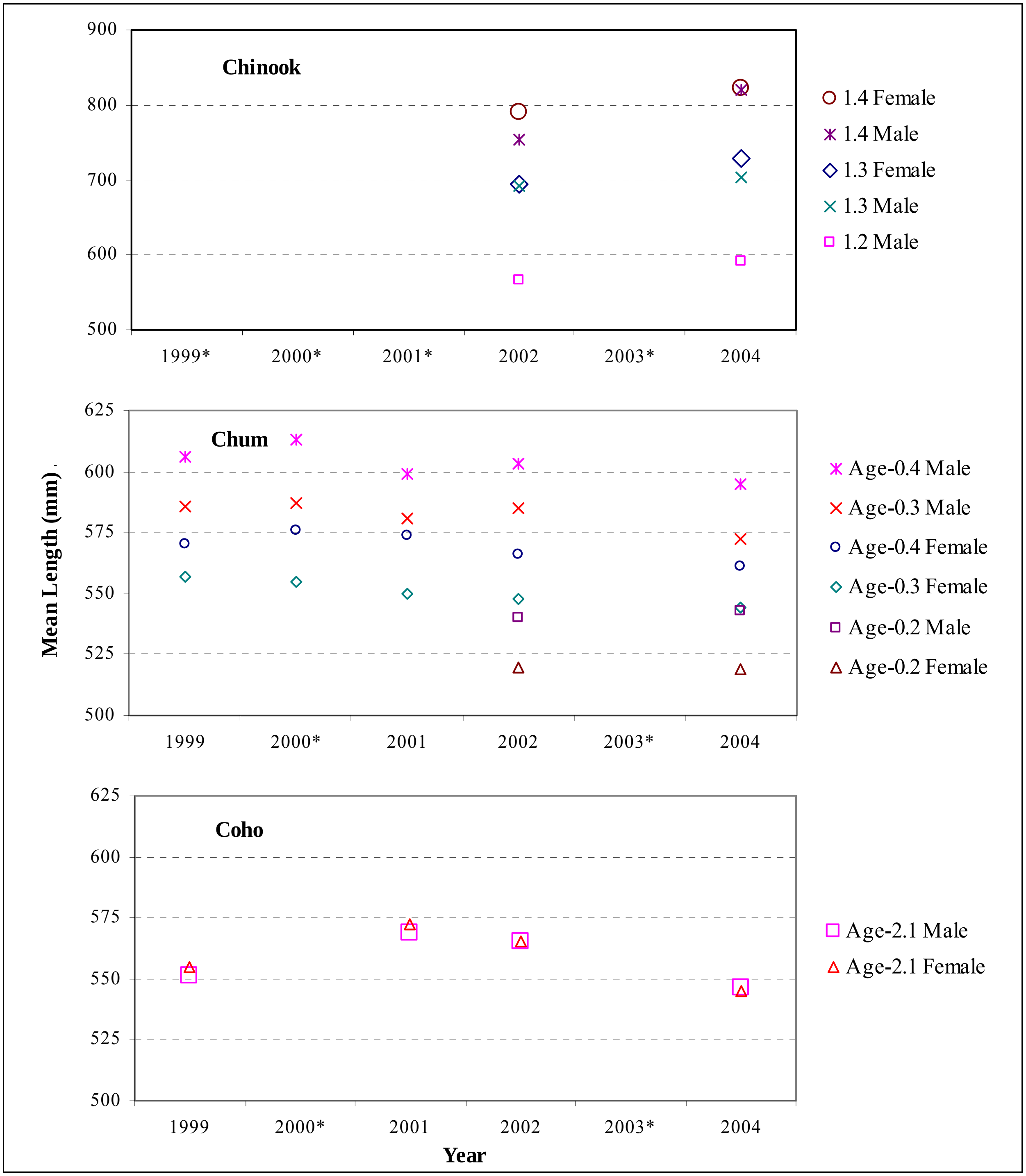


Figure 13.–Historical intra-annual mean length at age for male and female Chinook salmon at the Tatlawiksuk River weir by sample date.



Note: * = Year excluded because of insufficient data.

Figure 14.–Historical annual mean length of Chinook, chum, and coho salmon at the Tatlawiksuk River weir.

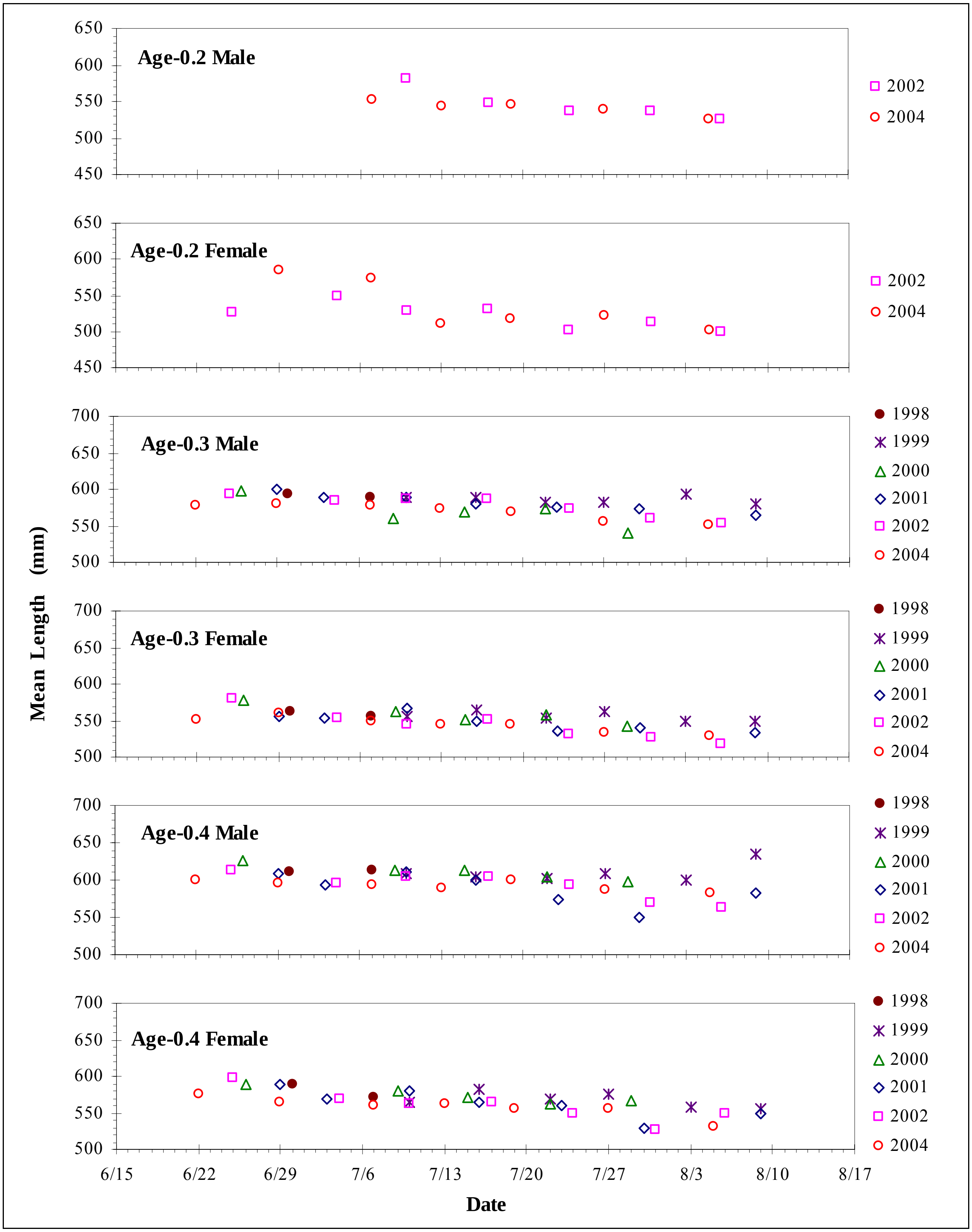


Figure 15.–Historical intra-annual mean length (mm) at age for male and female chum salmon at the Tatlawiksuk River weir by sample date.

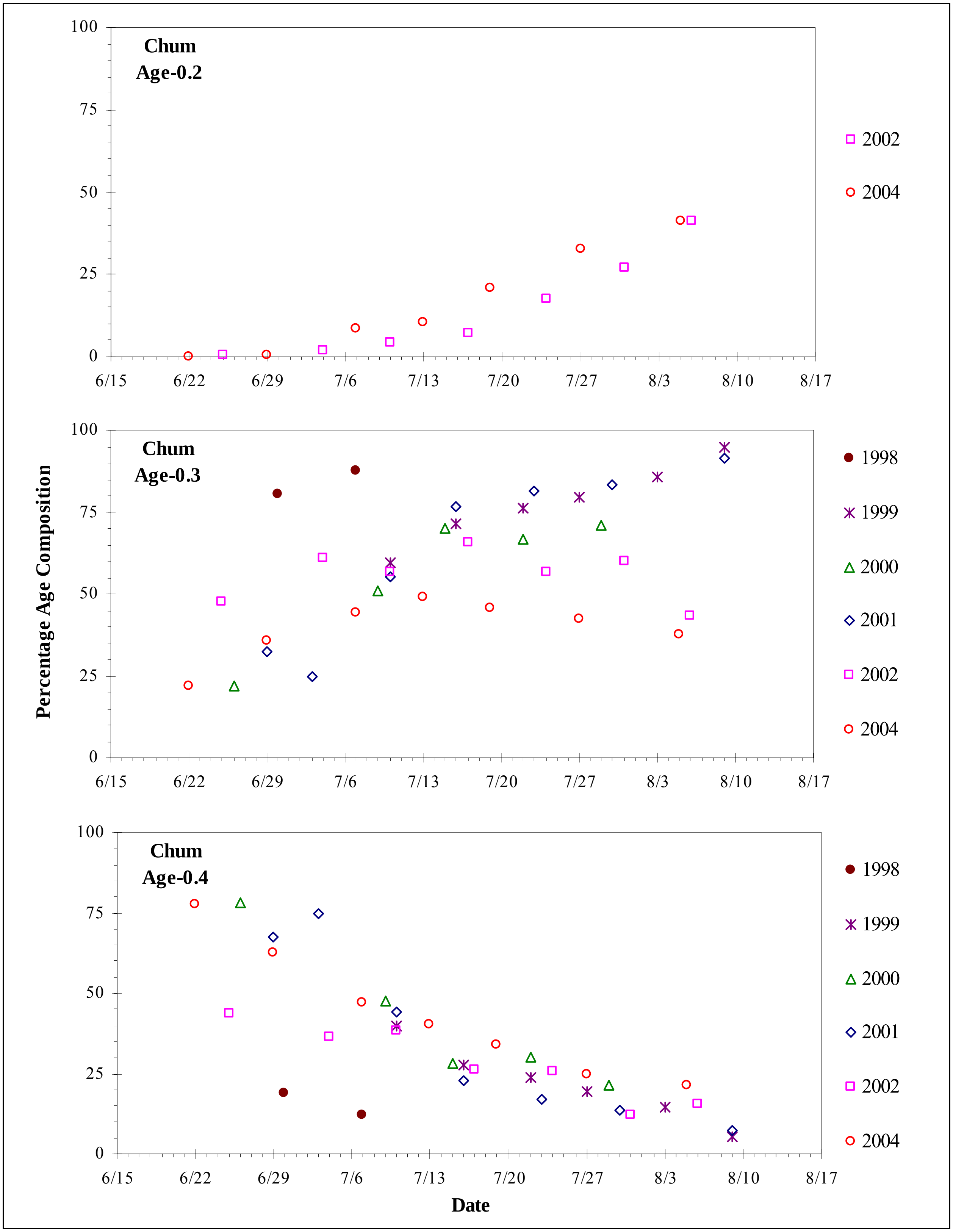


Figure 16.–Historical intra-annual age composition of chum salmon at the Tatlawiksuk River weir by sample date.

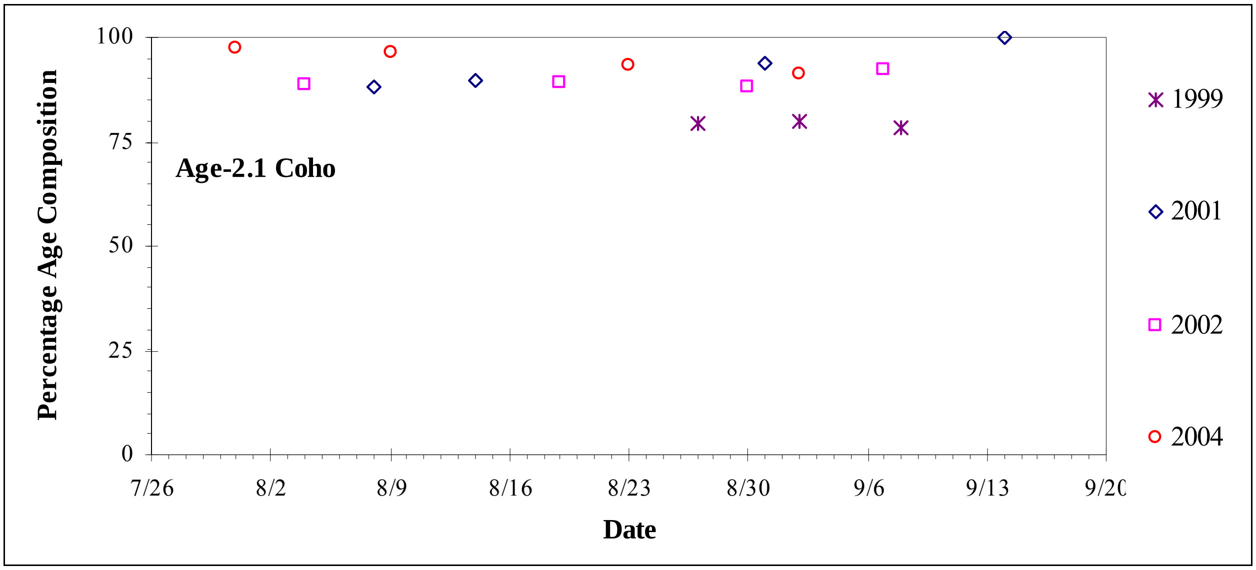


Figure 17.–Historical intra-annual percentage of age-2.1 coho salmon at the Tatlawiksuk River weir by sample date.

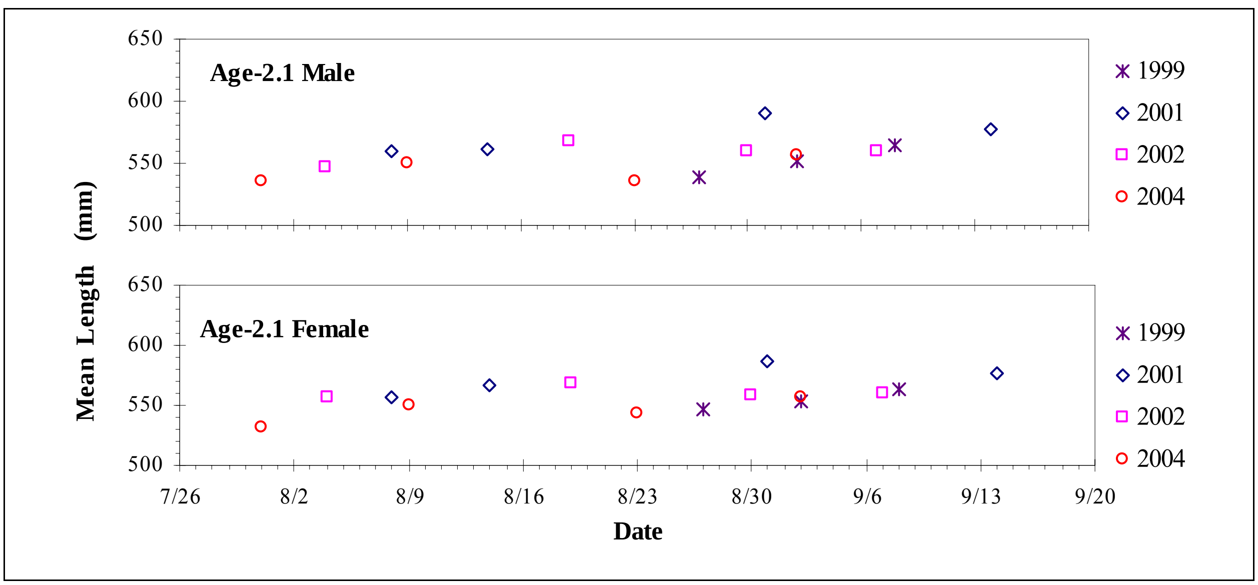
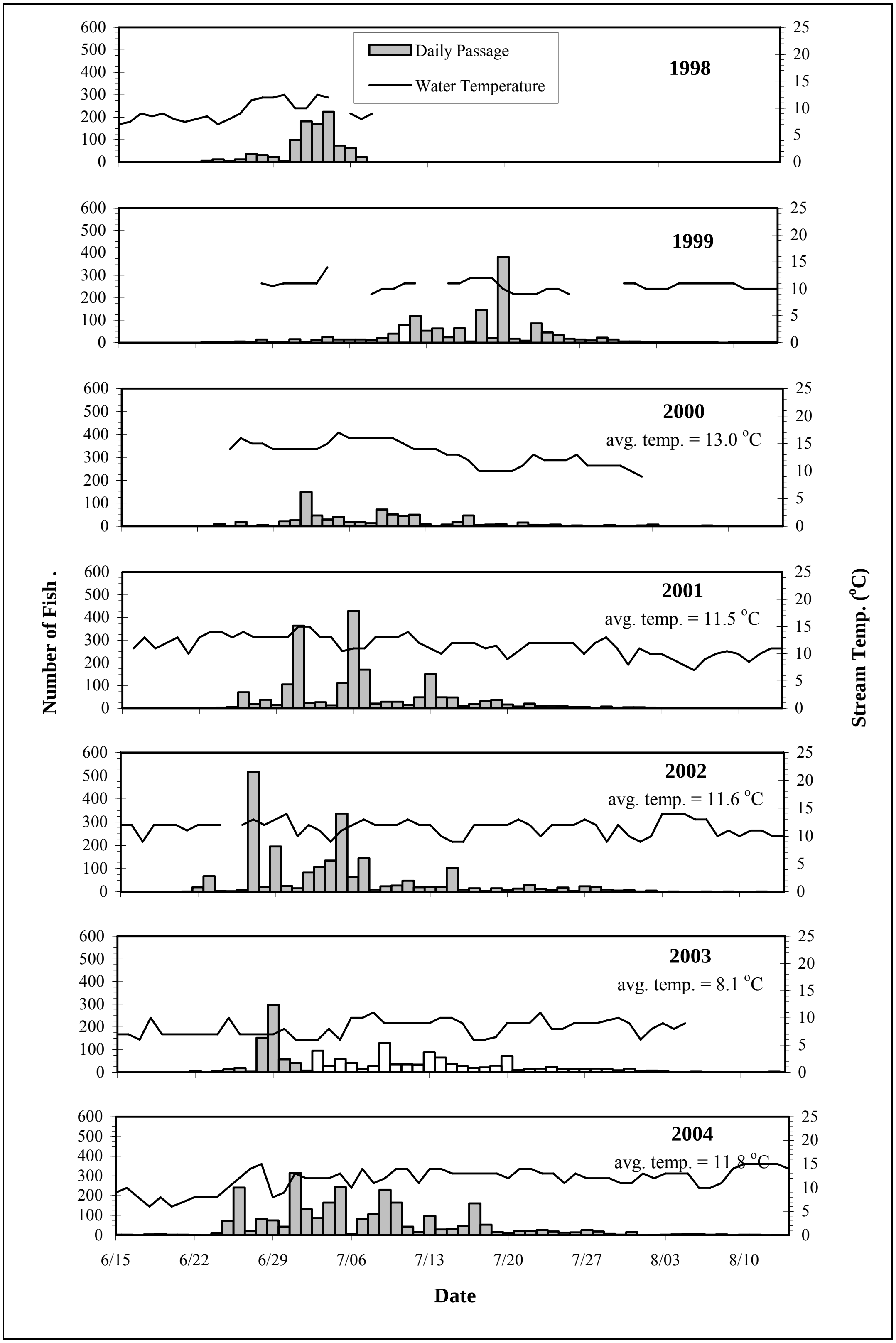
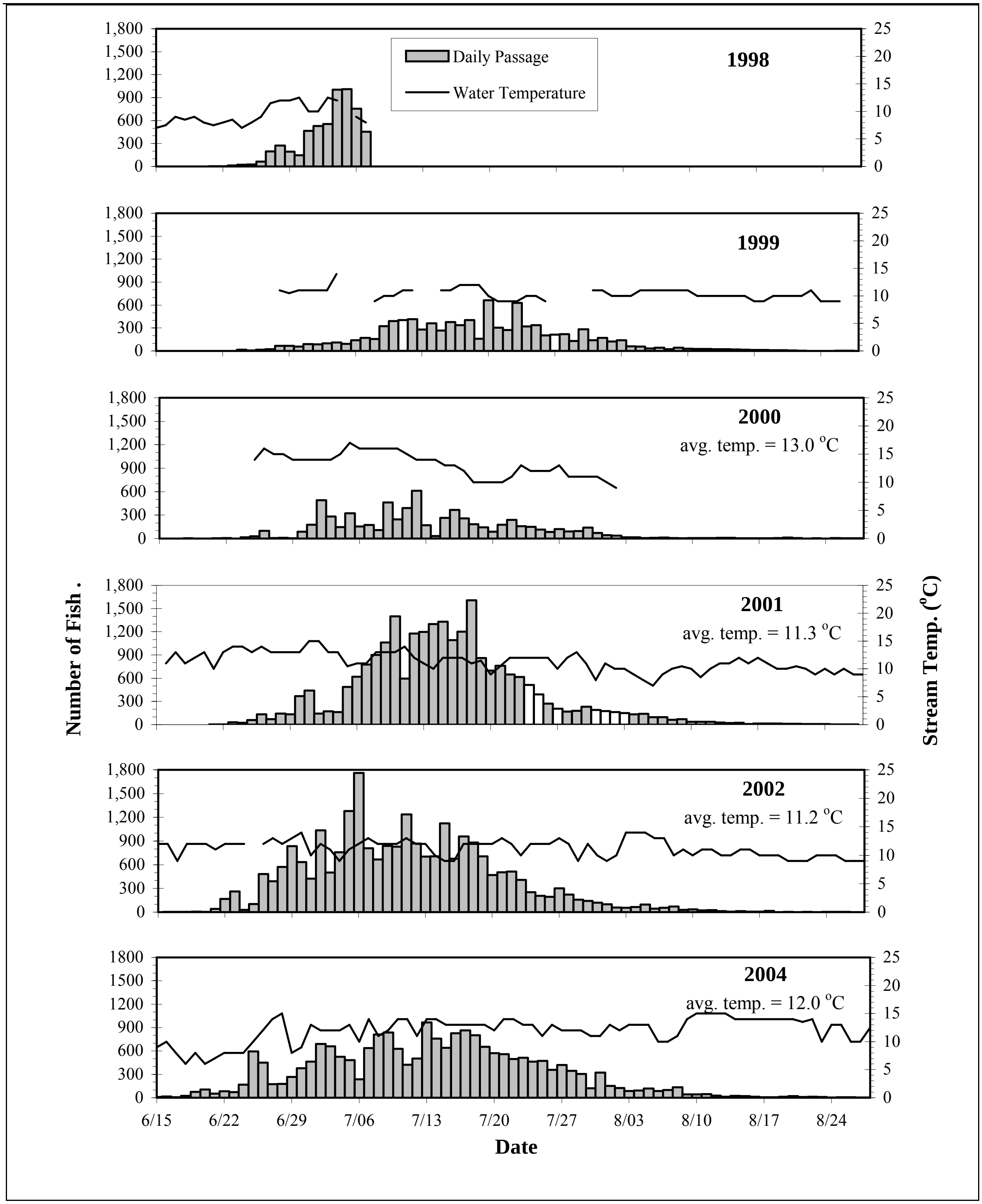


Figure 18.–Historical intra-annual mean length of age-2.1 coho salmon at the Tatlawiksuk River weir by sex and sample date.



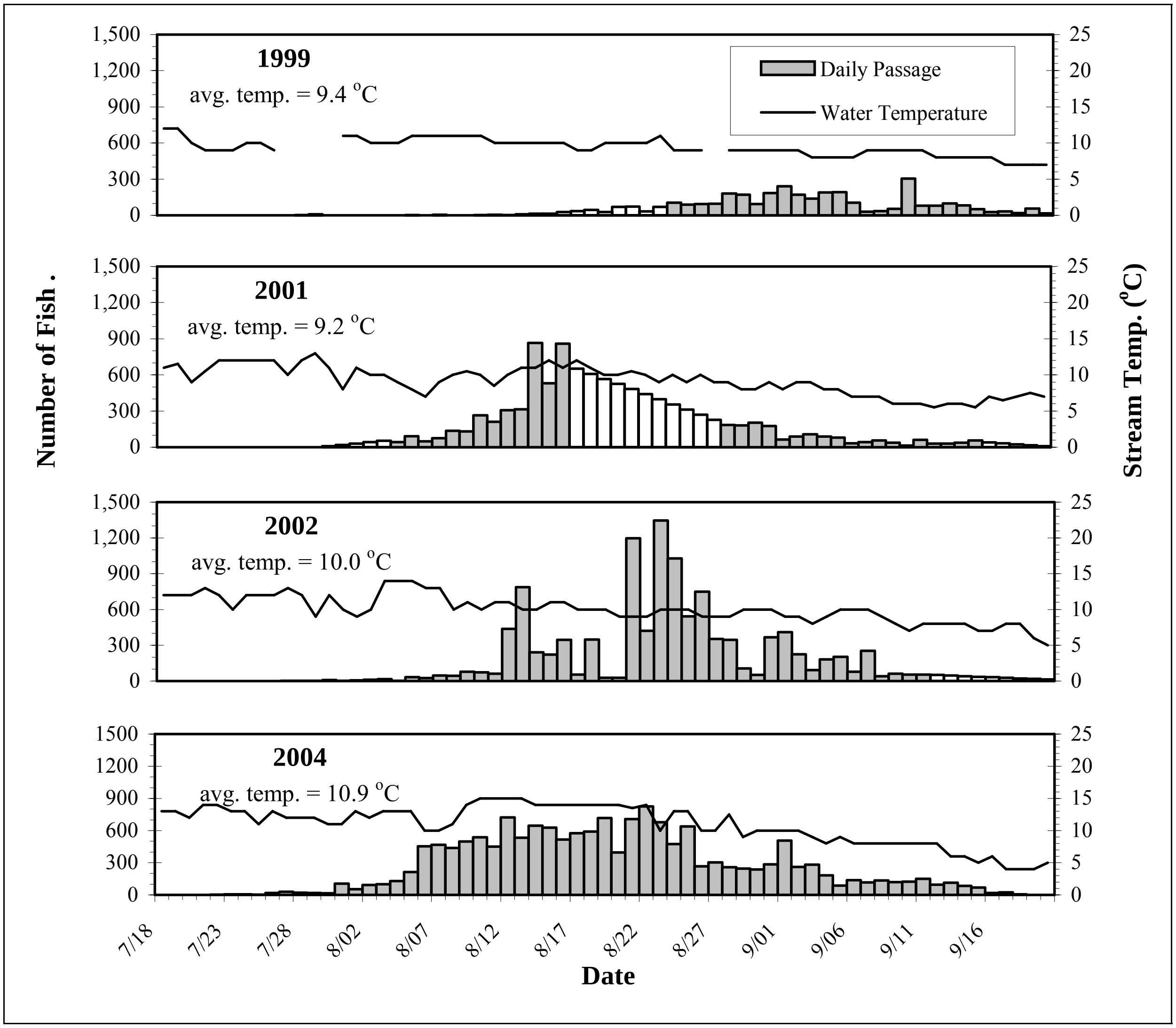
Note: Solid bars represent observed passage, open bars represent estimated passage.

Figure 19.–Historical daily Chinook salmon passage relative to daily morning stream temperature at the Tatlawiksuk River weir.



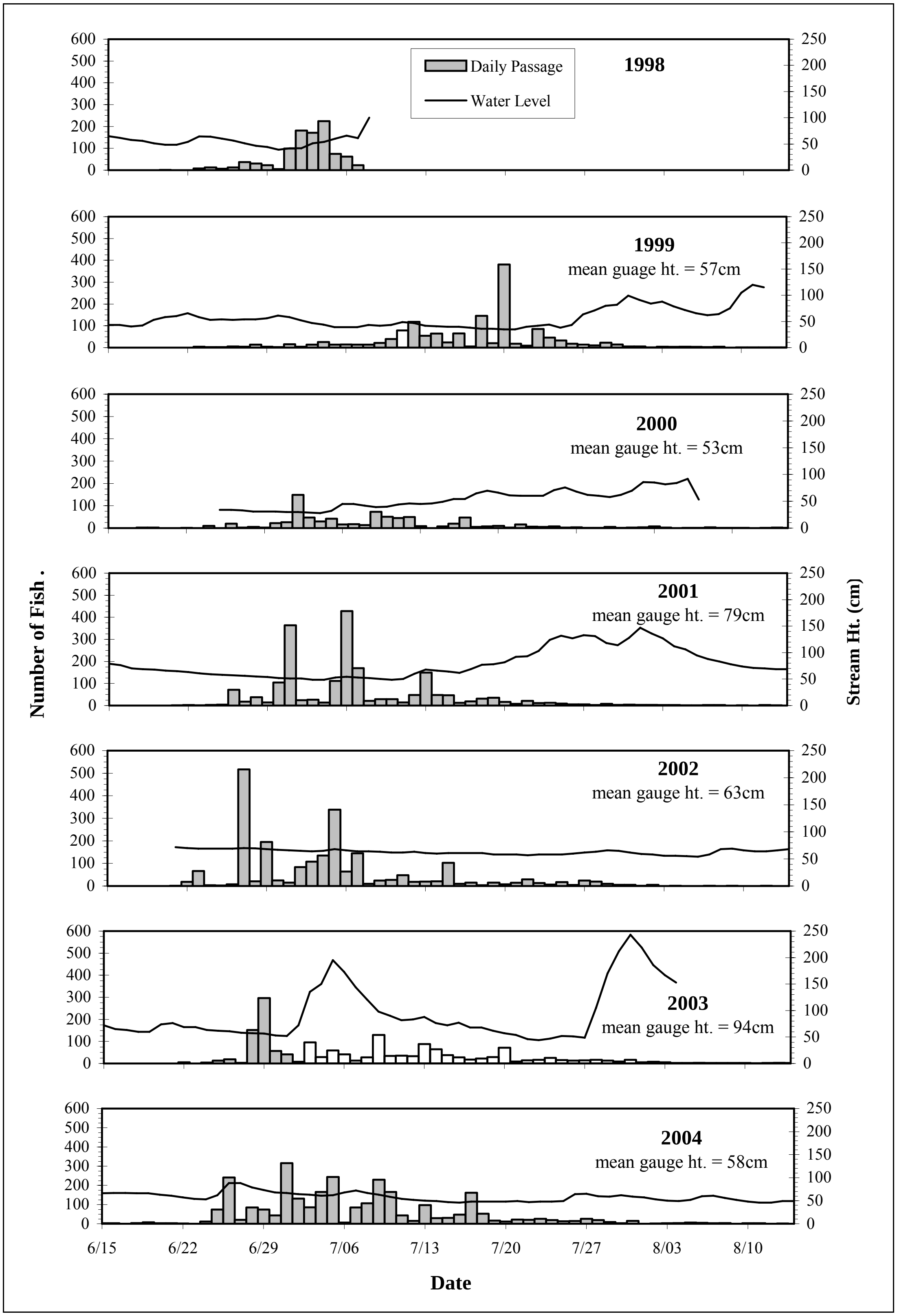
Note: Solid bars represent observed passage, open bars represent estimated passage.

Figure 20.–Historical daily chum salmon passage relative to daily morning stream temperature at the Tatlawiksuk River weir.



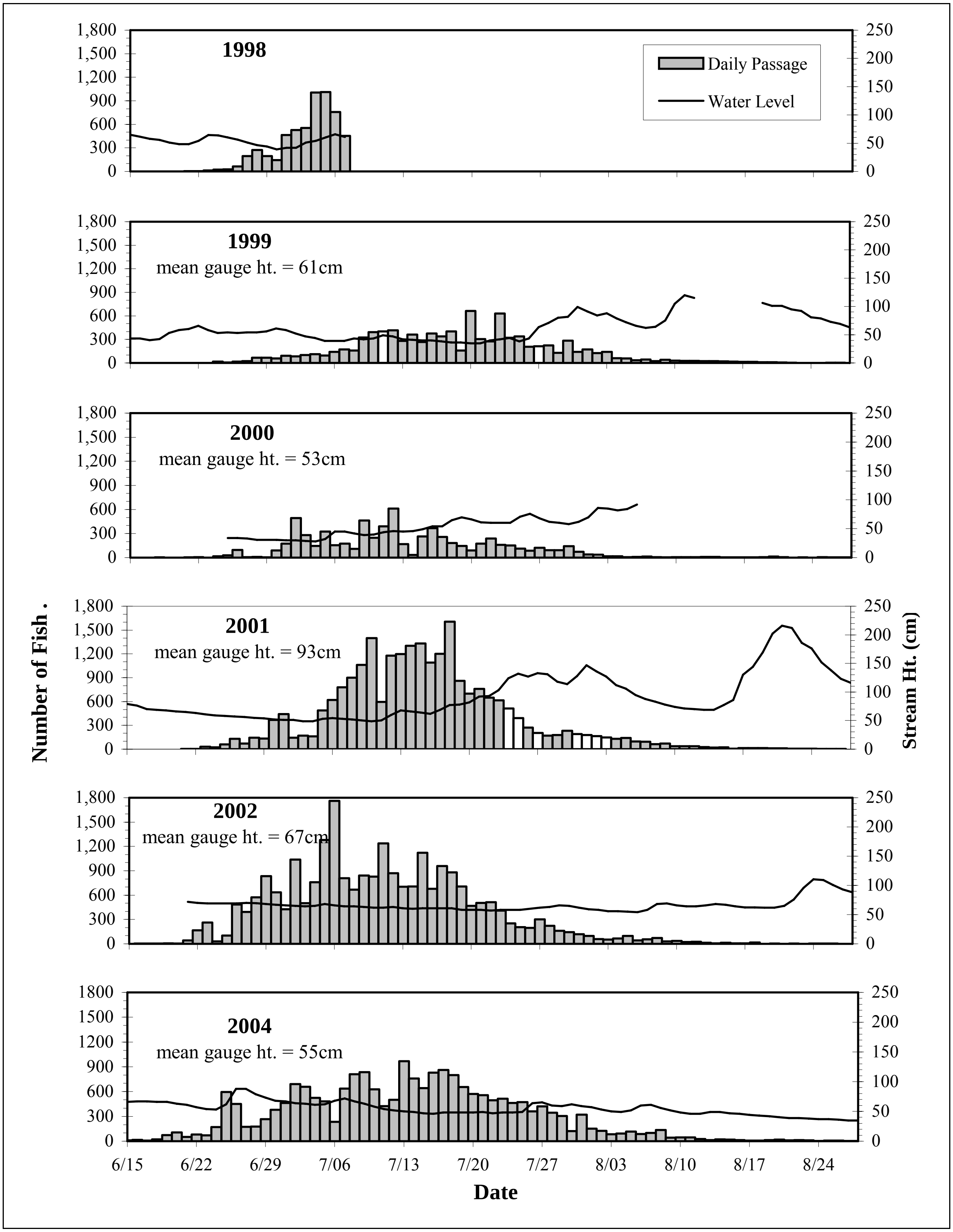
Note: Solid bars represent observed passage, open bars represent estimated passage.

Figure 21.–Historical daily coho salmon passage relative to daily morning stream temperature at the Tatlawiksuk River weir.



Note: Solid bars represent observed passage, open bars represent estimated passage.

Figure 22.–Historical daily Chinook salmon passage relative to daily morning stream gauge height at the Tatlawiksuk River weir.



Note: Solid bars represent observed passage, open bars represent estimated passage.

Figure 23.–Historical daily chum salmon passage relative to daily morning stream gauge height at the Tatlawiksuk River weir.

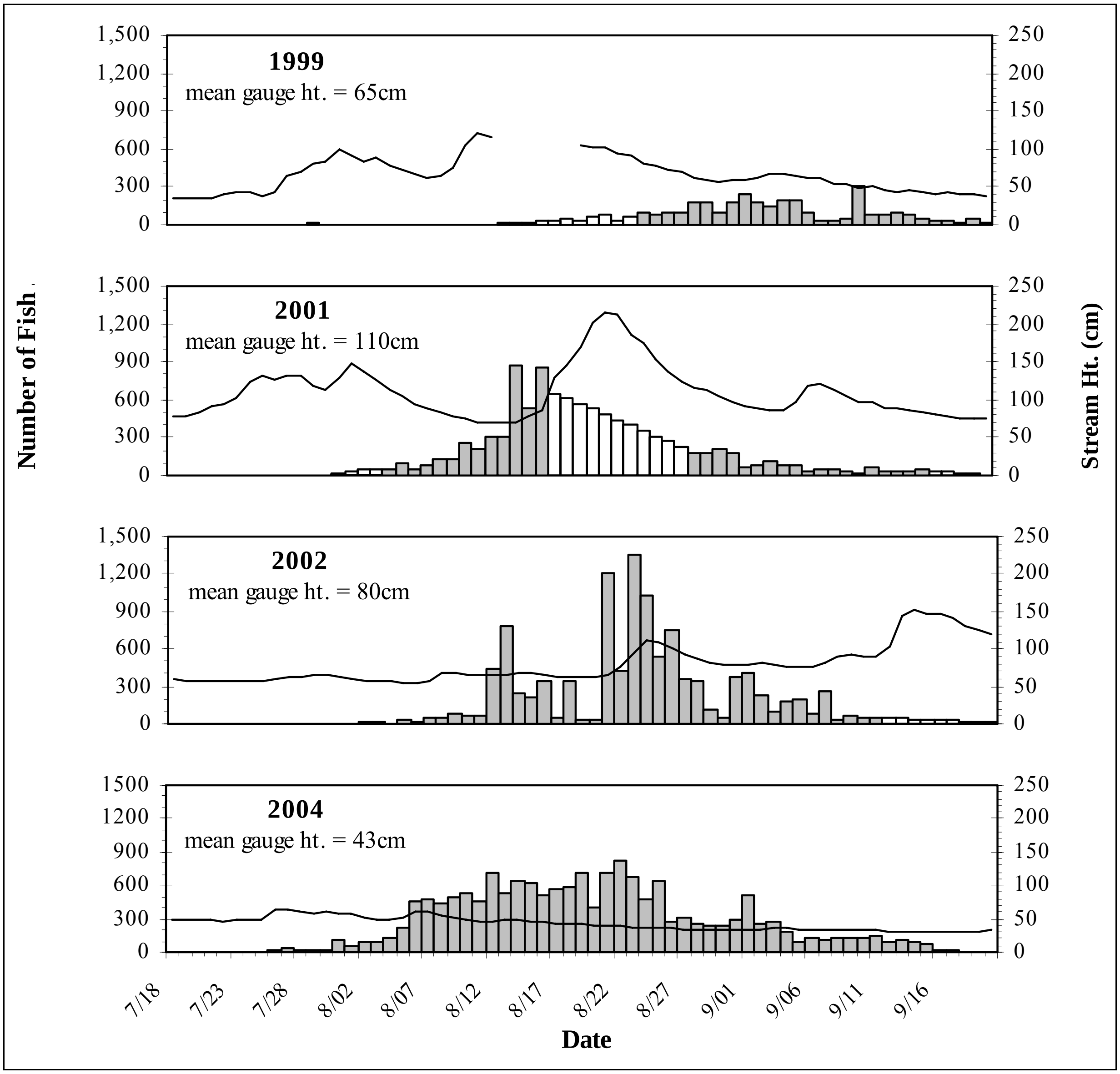


Figure 24.–Historical daily coho salmon passage relative to daily morning stream gauge height at the Tatlawiksuk River weir.

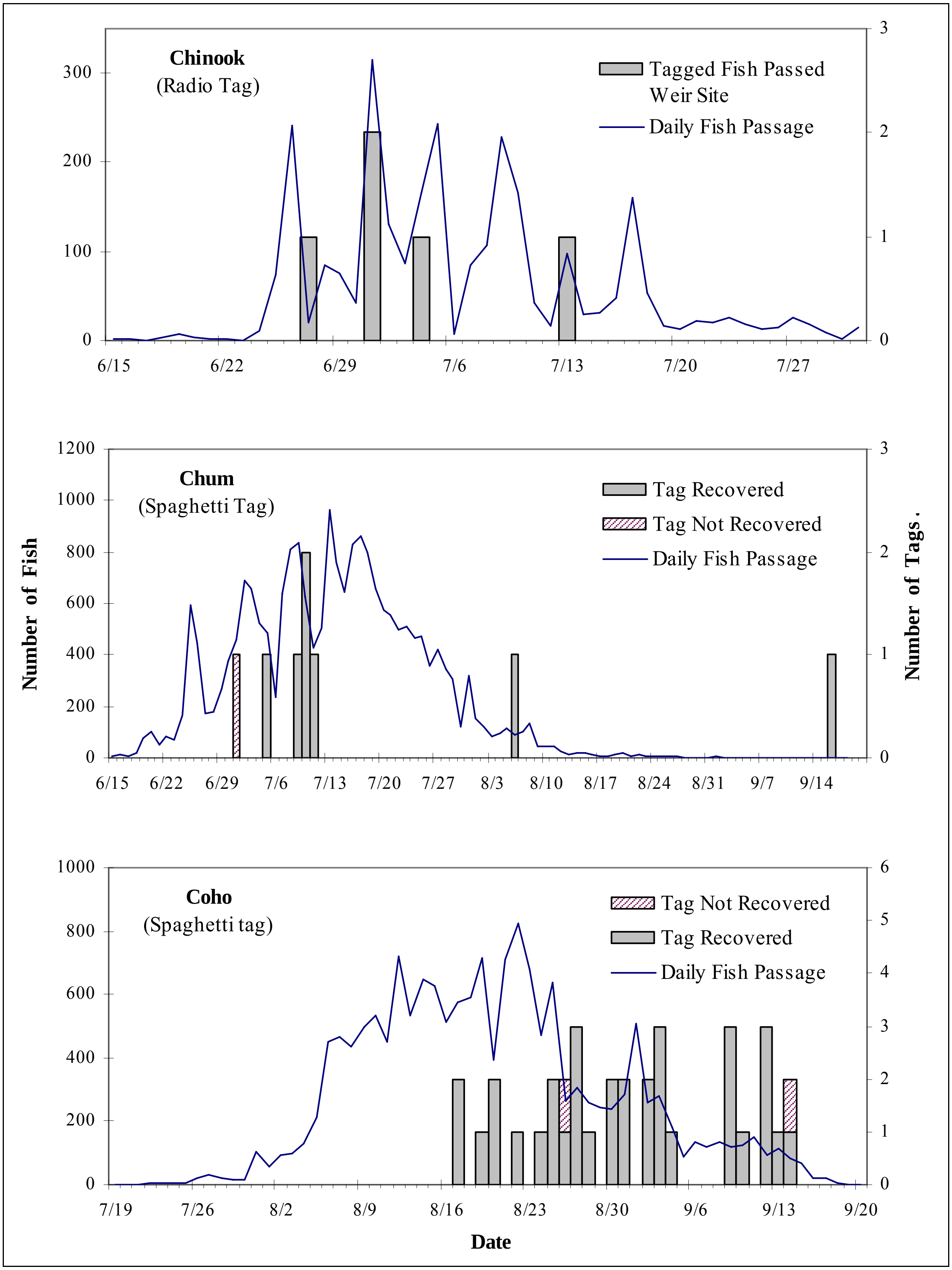
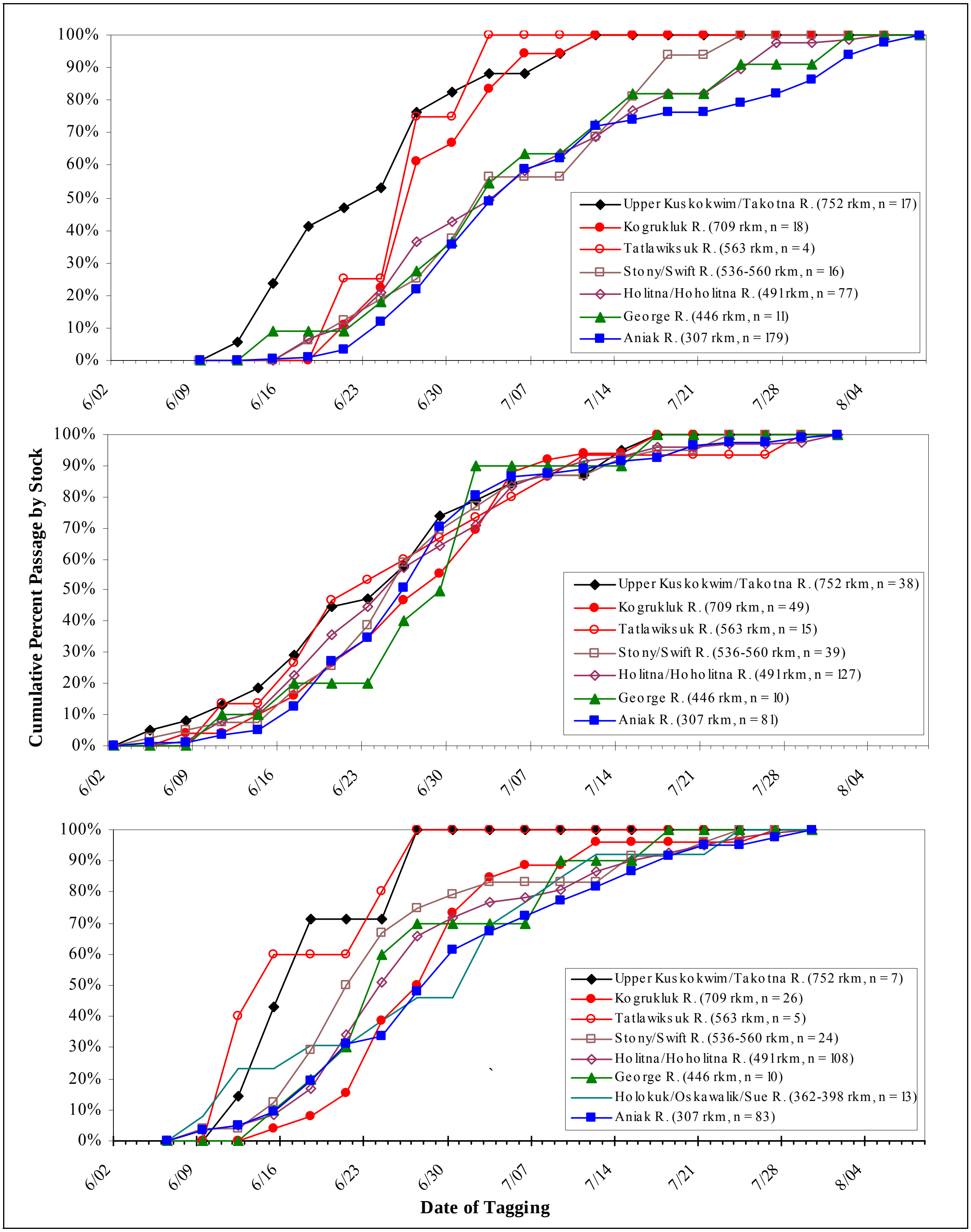


Figure 25.–Daily detections of tagged Chinook, chum, and coho salmon at the Tatlawiksuk River weir in 2004 compared to daily escapement.



Source: Stuby 2003, 2004, 2005. Note: River kilometer (rkm) from marine waters and sample size in parentheses.

Figure 26.–Historical cumulative percent passage of selected Chinook salmon stocks at the Kalskag-Aniak tagging site based on radio tagging studies.

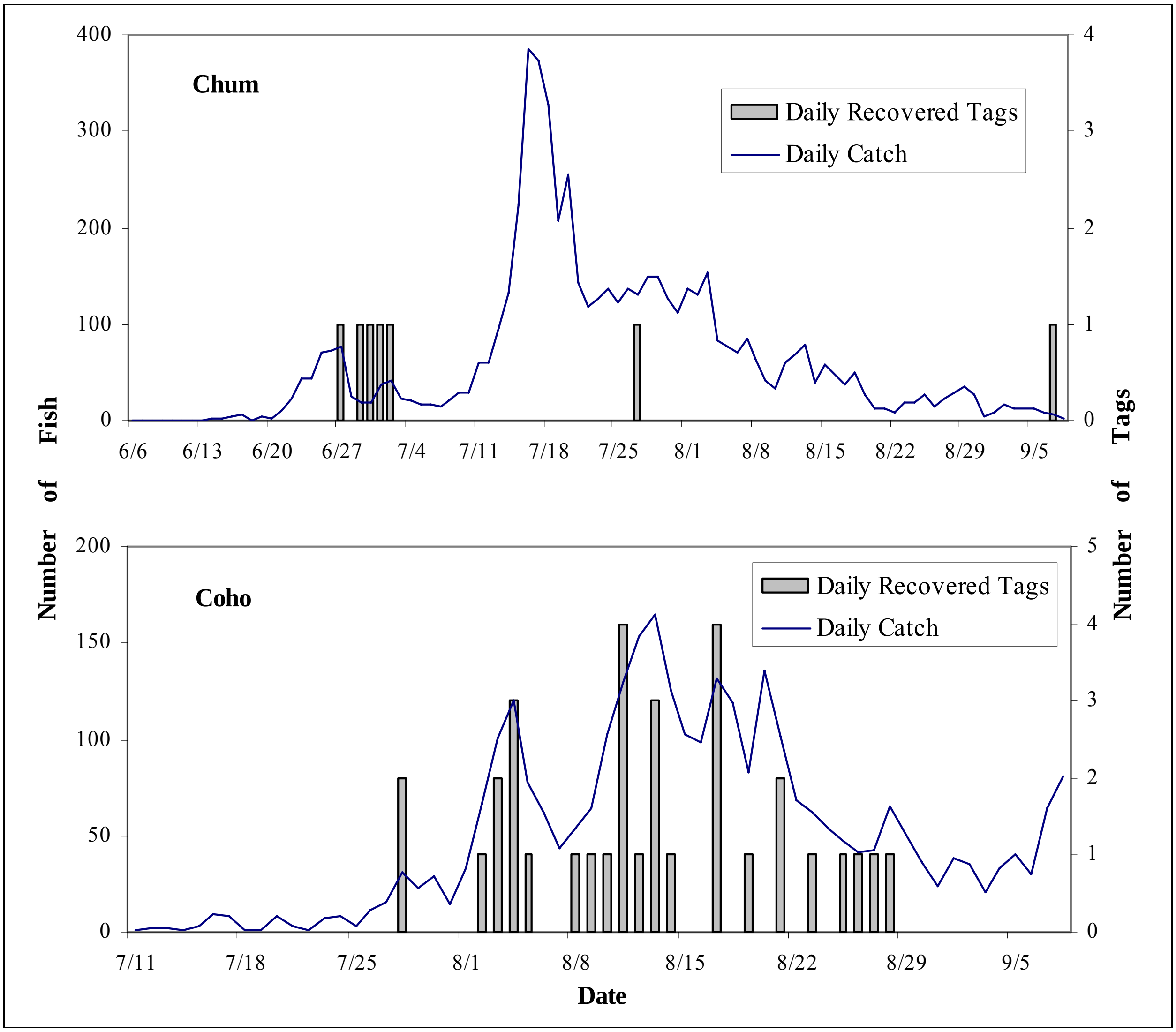
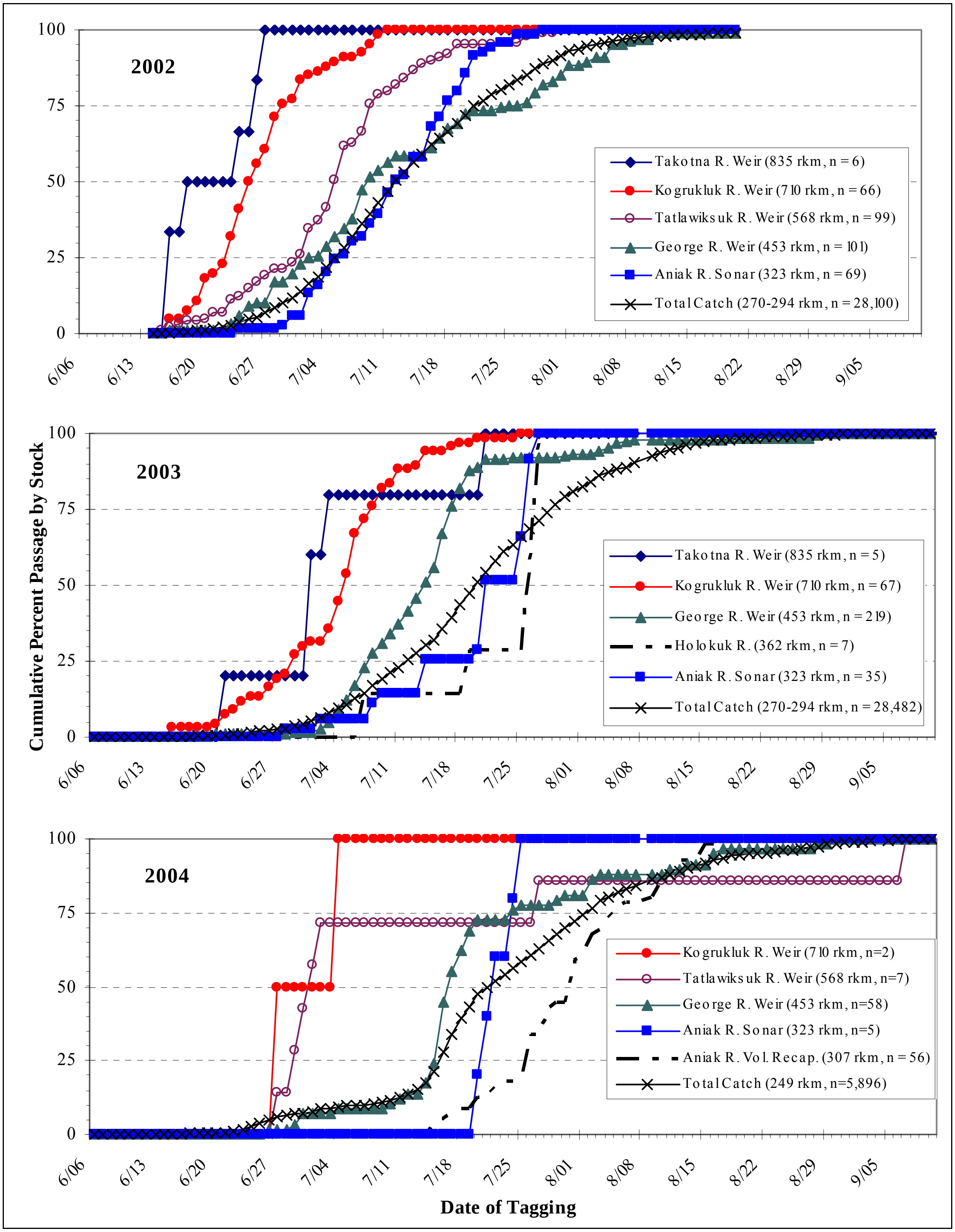


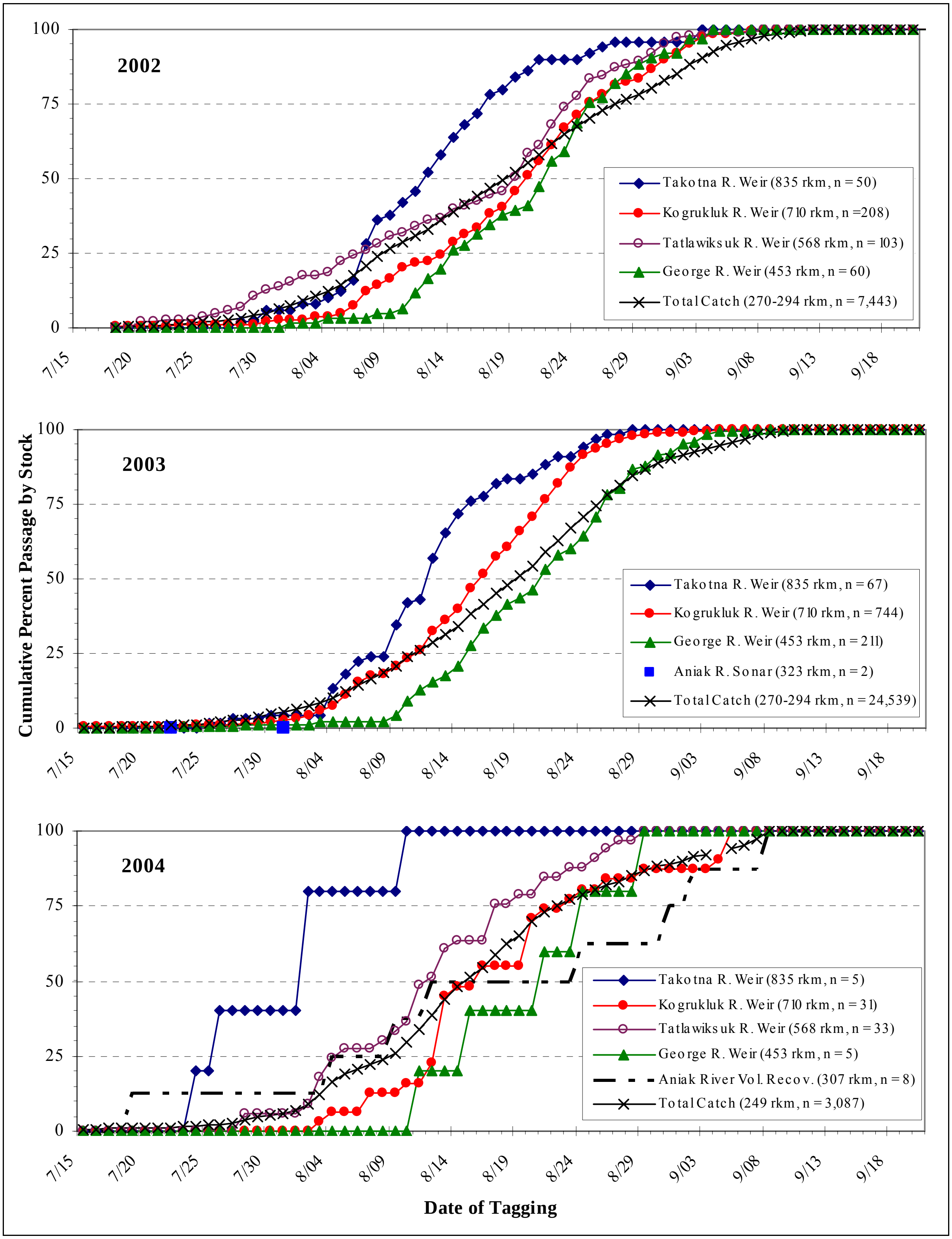
Figure 27.–Occurrence of chum and coho salmon tags recovered at Tatlawiksuk River weir by date tagged in comparison to the daily catch of the species at the Lower Kalskag tagging site.



Source: Kerkvliet et al. 2003; 2004; Pawluk et al. *In prep*.

Note: River kilometer (rkm) from marine waters and sample size in parentheses.

Figure 28.–Historical cumulative percent passage of chum salmon stocks at the Kalskag–Aniak tagging site based on tag returns at selected Kuskokwim River tributaries.



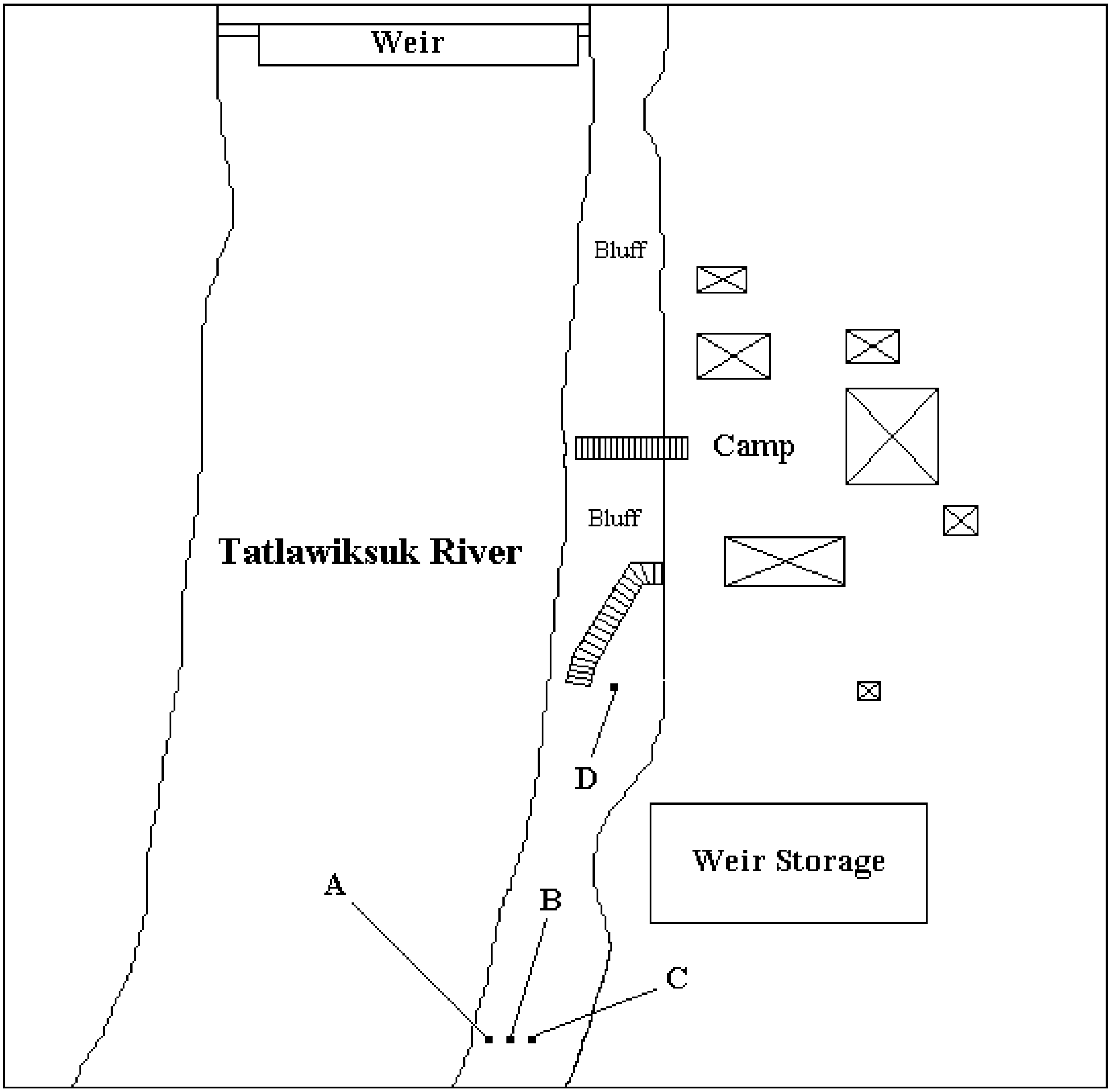
Source: Kerkvliet et al. 2003; 2004; Pawluk et al. *In prep*.

Note: River kilometer (rkm) from marine waters and sample size in parentheses.

Figure 29.–Historical percent passage of coho salmon stocks at the Kalskag–Aniak tagging site based on tag returns at selected Kuskokwim River tributaries.

APPENDIX A

Appendix A1.–Locations and descriptions of stream height benchmarks at Tatlawiksuk River weir.



APPENDIX B

Appendix B1.–Daily passage of sockeye and pink salmon, and non-salmon species observed at Tatlawiksuk River weir, 2004.

Date	Sockeye Salmon	Pink Salmon	Longnose Sucker	Whitefish	Arctic Grayling	Northern Pike
6/15	0	0	8	9	0	0
6/16	0	0	3	0	5	0
6/17	0	0	2	0	0	0
6/18	0	0	3	1	2	0
6/19	0	0	4	3	3	0
6/20	0	0	21	1	18	0
6/21	0	0	5	0	2	0
6/22	0	0	0	4	2	0
6/23	0	0	0	0	0	1
6/24	0	0	1	0	2	0
6/25	0	0	9	1	3	0
6/26	0	0	3	0	5	0
6/27	0	0	2	0	2	0
6/28	0	0	2	0	0	0
6/29	0	0	0	0	2	0
6/30	0	0	0	0	0	0
7/1	0	0	0	0	0	0
7/2	0	0	0	0	0	0
7/3	0	0	0	0	0	0
7/4	0	0	0	0	1	0
7/5	0	0	0	0	0	0
7/6	0	0	0	0	0	0
7/7	0	0	0	0	0	0
7/8	0	0	1	0	0	0
7/9	0	0	0	0	0	0
7/10	0	0	2	0	0	0
7/11	0	0	0	1	0	0
7/12	0	0	1	0	0	0
7/13	0	0	0	0	2	0
7/14	0	0	0	1	0	0
7/15	0	0	1	0	0	0
7/16	0	0	1	0	0	0
7/17	0	0	5	0	1	0
7/18	0	0	0	0	0	0
7/19	1	0	0	0	0	0
7/20	0	0	0	0	0	0
7/21	0	0	0	0	0	0
7/22	0	0	0	0	0	0
7/23	0	0	0	0	0	0
7/24	0	0	0	0	0	0
7/25	0	0	0	0	0	0
7/26	0	0	0	0	0	0
7/27	0	0	0	0	0	0
7/28	0	0	0	0	0	0
7/29	0	0	0	0	0	0
7/30	0	0	0	0	0	0
7/31	1	0	1	0	0	0
8/1	0	0	0	0	1	1
8/2	0	0	0	0	0	0

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Appendix B1.–Page 2 of 2.

Date	Sockeye Salmon	Pink Salmon	Longnose Sucker	Whitefish	Arctic Grayling	Northern Pike
8/3	0	0	0	0	0	1
8/4	0	0	0	0	0	0
8/5	1	0	0	0	0	0
8/6	0	0	0	0	0	0
8/7	0	0	0	0	2	2
8/8	0	0	0	1	0	0
8/9	0	0	0	0	0	0
8/10	1	0	0	0	0	0
8/11	2	0	0	0	0	0
8/12	0	0	0	1	2	0
8/13	0	0	0	0	0	0
8/14	0	0	0	3	0	1
8/15	0	0	0	4	0	0
8/16	0	0	0	3	0	1
8/17	0	0	0	0	0	2
8/18	0	0	0	1	0	1
8/19	0	0	0	1	0	1
8/20	0	0	0	0	0	1
8/21	0	0	0	0	0	0
8/22	0	0	0	0	0	0
8/23	0	0	0	0	0	0
8/24	0	0	0	0	0	1
8/25	1	0	0	0	0	0
8/26	0	0	0	0	0	1
8/27	0	0	0	0	0	1
8/28	0	0	0	0	2	1
8/29	0	0	0	0	0	2
8/30	0	0	0	0	0	1
8/31	0	0	0	0	0	2
9/1	0	0	0	0	0	2
9/2	0	0	0	0	0	2
9/3	0	0	0	0	0	0
9/4	0	0	0	0	0	0
9/5	1	0	0	0	0	0
9/6	0	0	0	0	0	0
9/7	0	0	0	0	0	1
9/8	0	0	0	0	0	0
9/9	0	0	0	0	0	0
9/10	1	0	0	0	0	0
9/11	0	0	0	0	0	4
9/12	0	0	0	0	0	0
9/13	0	0	0	0	0	2
9/14	0	0	0	0	0	2
9/15	0	0	0	0	0	1
9/16	0	0	0	0	0	0
9/17	0	0	0	0	0	6
9/18	1	0	0	0	0	1
9/19	ND	ND	ND	ND	ND	ND
9/20	ND	ND	ND	ND	ND	ND
Total	10	0	75	35	57	42

Note: ND = no data.

APPENDIX C

Appendix C1.–Historical daily carcass counts of Chinook, chum, and coho salmon at Tatlawiksuk River weir.

	Chinook					Chum					Coho				
Date	1999	2000	2001	2002	2004	1999	2000	2001	2002	2004	1999	2000	2001	2002	2004
6/15	0	0	[a]	[a]	0	0	0	[a]	[a]	0	0	0	[a]	[a]	0
6/16	0	0	[a]	[a]	0	0	0	[a]	[a]	0	0	0	[a]	[a]	0
6/17	0	0	[a]	0 [b]	0	0	0	[a]	0 [b]	0	0	0	[a]	0 [b]	0
6/18	0	0	[a]	0	0	0	0	[a]	0	0	0	0	[a]	0	0
6/19	0	0	[a]	0	0	0	0	[a]	0	0	0	0	[a]	0	0
6/20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/23	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
6/24	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
6/25	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
6/26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/28	0	0	0	0	0	0	0	0	4	2	0	0	0	0	0
6/29	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0
6/30	0	0	0	1	0	0	0	0	3	0	0	0	0	0	0
7/01	0	0	0	0	0	1	1	3	3	4	0	0	0	0	0
7/02	0	0	0	0	0	1	1	3	3	1	0	0	0	0	0
7/03	0	0	0	0	0	0	0	3	6	1	0	0	0	0	0
7/04	0	0	0	0	0	0	1	3	3	2	0	0	0	0	0
7/05	0	1	0	0	1	0	0	0	6	1	0	0	0	0	0
7/06	0	0	0	0	0	4	0	5	4	0	0	0	0	0	0
7/07	0	0	0	0	0	0	1	1	4	3	0	0	0	0	0
7/08	0	0	0	0	0	2	1	4	7	8	0	0	0	0	0
7/09	0	0	0	0	0	11	0	5	11	12	0	0	0	0	0
7/10	0	0	0	0	0	7	3	11	11	11	0	0	0	0	0
7/11	0	0	0	0	0	5	8	6	15	12	0	0	0	0	0
7/12	0	0	0	0	0	12	17	4	20	9	0	0	0	0	0
7/13	0	0	0	0	0	0	11	5	30	19	0	0	0	0	0
7/14	0	1	0	0	0	2	5	4	36	20	0	0	0	0	0
7/15	0	0	0	0	0	4	9	3	19	36	0	0	0	0	0
7/16	0	0	0	0	0	9	11	9	21	35	0	0	0	0	0
7/17	0	0	0	0	0	11	8	3	38	18	0	0	0	0	0
7/18	0	0	0	0	0	11	14	10	23	23	0	0	0	0	0

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	Chinook					Chum					Coho				
Date	**1999**	**2000**	**2001**	**2002**	**2004**	**1999**	**2000**	**2001**	**2002**	**2004**	**1999**	**2000**	**2001**	**2002**	**2004**
7/19	0	0	0	0	0	4	12	0	47	33	0	0	0	0	0
7/20	0	0	0	0	0	16	9	27	62	25	0	0	0	0	0
7/21	0	0	0	1	1	12	10	38	33	24	0	0	0	0	0
7/22	0	0	0	2	1	12	10	55	58	12	0	0	0	0	0
7/23	0	0	1	0	0	17	15	63	66	28	0	0	0	0	0
7/24	0	0	1 [b]	0	0	18	9	49 [b]	74	21	0	0	0 [b]	0	0
7/25	0	0	0 [b]	0	0	11	11	71 [b]	53	31	0	0	0 [b]	0	0
7/26	0	0	2	0	0	21	11	62	47	40	0	0	0	0	0
7/27	0	0	2 [b]	3	0	32	11	65 [b]	38	35	0	0	0 [b]	0	0
7/28	1	0	2	0	0	17	0	50	42	20	0	0	0	0	0
7/29	1	0	0	1	1	19	14	49	31	16	0	0	0	0	0
7/30	0	0	2	0	0	31	4	60	25	14	0	0	0	0	0
7/31	1	1	0 [b]	0	0	43	15	57 [b]	61	29	0	0	0 [b]	0	0
8/01	0	1	[a]	0	0	50	15	[a]	53	1	0	0	[a]	0	0
8/02	2	0	2 [b]	0	2	10	15 [b]	35 [b]	44	15	0	0	0 [b]	0	0
8/03	1	3	3 [b]	0	0	20	8	35 [b]	40	8	0	0	0 [b]	0	0
8/04	2	2	0	0	0	59	12	37	40	17	0	0	0	0	0
8/05	0	0	2	0	0	11	10	37	40	9	0	0	0	1	0
8/06	4	0	1	0	0	23	0	63	39	21	0	0	0	0	0
8/07	10	1	0	0	0	14	7	28	40	13	0	0	0	0	0
8/08	3	1	1	0	0	25	4	36	21	8	0	0	0	0	0
8/09	11	0	0	0	0	49	0	20	20	10	0	0	0	0	2
8/10	0 [b]	0	0	0	1	11 [b]	0	36	9	5	0 [b]	0	0	0	1
8/11	[a]	0	0	1	0	[a]	0	15	4	15	[a]	0	0	0	0
8/12	[a]	0	0	0	0	[a]	0	22	7	10	[a]	0	0	0	0
8/13	[a]	0	0	0	0	[a]	0	27	7	6	[a]	0	0	0	0
8/14	[a]	0	0	0	1	[a]	0	18	6	1	[a]	0	0	0	0
8/15	[a]	[a]	0	0	0	[a]	[a]	4	3	6	[a]	[a]	0	0	2
8/16	[a]	[a]	0	0	0	[a]	[a]	22	9	2	[a]	[a]	0	0	0
8/17	[a]	[a]	0 [b]	0	0	[a]	[a]	8 [b]	5	0	[a]	[a]	0 [b]	0	1
8/18	[a]	[a]	0 [b]	0	0	[a]	[a]	4 [b]	2	1	[a]	[a]	0 [b]	0	0
8/19	0 [b]	[a]	[a]	0	0	2 [b]	[a]	[a]	4	1	0 [b]	[a]	[a]	0	0
8/20	[a]	[a]	0 [b]	0	0	[a]	[a]	1 [b]	0	0	[a]	[a]	0 [b]	0	0
8/21	[a]	[a]	[a]	0	0	[a]	[a]	[a]	1	2	[a]	[a]	[a]	0	0
8/22	[a]	[a]	[a]	1	0	[a]	[a]	[a]	2	2	[a]	[a]	[a]	0	0

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Appendix C1.–Page 3 of 3.

Date	Chinook					Chum					Coho				
	1999	2000	2001	2002	2004	1999	2000	2001	2002	2004	1999	2000	2001	2002	2004
8/23	0 [b]	[a]	[a]	0	0	1 [b]	[a]	[a]	0	2	0 [b]	[a]	[a]	0	0
8/24	0	[a]	[a]	0	0	3	[a]	[a]	0	0	0	[a]	[a]	0	0
8/25	1	[a]	[a]	0	0	0	[a]	[a]	0	0	0	[a]	[a]	0	0
8/26	0	[a]	[a]	0	0	0	[a]	[a]	0	0	0	[a]	[a]	0	0
8/27	0	[a]	[a]	0	0	0	[a]	[a]	0	0	0	[a]	[a]	0	0
8/28	0	[a]	0	0	0	0	[a]	0	0	0	0	[a]	0	0	0
8/29	0	[a]	0	0	0	0	[a]	1	0	0	0	[a]	0	0	0
8/30	0	[a]	0	0	0	0	[a]	1	0	0	1	[a]	0	0	0
8/31	0	[a]	0	0	0	0	[a]	0	0	0	0	[a]	1	0	0
9/01	0	[a]	0	0	0	0	[a]	0	1	0	0	[a]	0	0	0
9/02	0	[a]	1	0	0	0	[a]	0	0	0	0	[a]	0	0	0
9/03	0	[a]	0	0	0	0	[a]	0	0	0	0	[a]	0	1	0
9/04	0	[a]	0	0	0	0	[a]	0	0	0	0	[a]	0	0	0
9/05	0	[a]	0	0	0	0	[a]	0	0	0	0	[a]	0	0	0
9/06	0	[a]	0	0	0	0	[a]	0	0	0	0	[a]	0	0	0
9/07	0	[a]	0	0	0	0	[a]	1	0	1	0	[a]	0	0	0
9/08	0	[a]	0	0	0	0	[a]	0	0	0	0	[a]	0	0	0
9/09	0	[a]	0	0	0	0	[a]	0	0	0	1	[a]	0	0	1
9/10	0	[a]	0	0	0	0	[a]	0	0	1	0	[a]	0	0	1
9/11	0	[a]	0	0	0	0	[a]	0	0	2	0	[a]	2	0	0
9/12	0	[a]	0	[a]	0	0	[a]	0	[a]	0	0	[a]	0	[a]	0
9/13	0	[a]	0	[a]	0	0	[a]	0	[a]	0	1	[a]	0	[a]	1
9/14	0	[a]	0	[a]	0	0	[a]	0	[a]	0	0	[a]	1	[a]	2
9/15	0	[a]	0	[a]	0	0	[a]	0	[a]	0	0	[a]	0	[a]	0
9/16	0	[a]	[a]	[a]	0	0	[a]	[a]	[a]	0	0	[a]	[a]	[a]	0
9/17	0	[a]	[a]	[a]	0	0	[a]	[a]	[a]	0	0	[a]	[a]	[a]	0
9/18	0	[a]	[a]	[a]	0	0	[a]	[a]	[a]	0	0	[a]	[a]	[a]	0
9/19	0	[a]	[a]	[a]	[a]	0	[a]	[a]	[a]	[a]	0	[a]	[a]	[a]	[a]
9/20	0	[a]	[a]	0 [b]	[a]	0	[a]	[a]	0 [b]	[a]	0	[a]	[a]	2 [b]	[a]
Total	37	11	20	10	8	611	293	1,180	1,304	707	3	0	4	4	11
% of Total Escapement	2.5%	1.3%	1.0%	0.4%	0.3%	6.4%	4.2%	5.0%	5.3%	3.3%	0.1%	0.0%	0.0%	0.0%	0.1%

Note: Operations terminated early in 1998 and 2003, and no carcasses were observed in those years.

[a] Weir was not operational, no count was conducted.

[b] Weir was not operational, count was incomplete.

APPENDIX D

Appendix D1.–Daily water conditions and weather at Tatlawiksuk River weir, 2004.

Observation		Sky	Wind Direction	Precipitation		Temperature °C		Water
Date	Time	Code[a]	and Velocity (mph)	Code[b]	Amount (mm)	Air	Water	Level (cm)
6/5	17:00	2	0	ND	ND	ND	ND	ND
6/6	07:30	1	0	ND	ND	ND	ND	ND
6/6	17:00	1	SW 5	ND	ND	ND	ND	ND
6/7	17:00	3	NW 10	ND	ND	ND	ND	72
6/8	17:00	4	NW 5	A	0.0	15	11	71
6/9	07:30	4	0	n.a.	3.0	9.5	8.5	71
6/9	17:00	3	0	n.a.	0.0	18	11	71
6/10	07:30	1	0	n.a.	4.2	9	10	72
6/10	17:00	3	V 10	n.a.	0.0	19	12	72
6/11	07:30	1	0	n.a.	0.0	10	10	77
6/12	10:30	2	0	n.a.	0.0	16	12	74
6/13	10:30	4	0	n.a.	0.0	12	12	68
6/14	07:30	4	0	A	7.6	10	10	67
6/15	07:30	4	0	n.a.	0.0	13	9	66
6/15	17:00	4	0	n.a.	0.0	20	13	66
6/16	07:30	4	0	A	0.0	8	10	67
6/16	17:00	4	0	A	0.0	15	11	67
6/17	07:30	4	0	A	1.0	10	8	67
6/17	17:00	4	W 0-5	n.a.	0.0	14	8	67
6/18	07:30	4	W 0-5	n.a.	0.0	8	6	66
6/18	17:00	4	0	n.a.	0.0	21	8	66
6/19	10:30	3	0	n.a.	0.0	15	8	66
6/19	17:00	1	S 0-5	n.a.	0.0	23	9	66
6/20	10:30	1	0	n.a.	0.0	18	6	63
6/20	17:00	2	0	n.a.	0.0	24	9	63
6/21	07:30	1	0	n.a.	0.0	12	7	61
6/21	17:00	2	SE 0-5	n.a.	0.0	24	15	59
6/22	07:30	3	SW 0-5	n.a.	0.0	12	8	57
6/22	17:00	4	SW 0-10	n.a.	0.0	22	15	57
6/23	07:30	4	SW 0-5	n.a.	0.0	13	8	54
6/23	17:00	4	SW 5-20	n.a.	0.0	15	13	53
6/24	07:30	4	SW 0-5	B	7.0	12	8	53
6/24	17:00	4	WSW 0-5	A	0.0	15	13	54
6/25	07:30	4	0	F	17.5	13	10	62
6/25	17:00	4	0	n.a.	0.0	18	12	71
6/26	10:30	3	N 0-10	F	1.0	17	12	88
6/26	17:00	1	N 5-15	n.a.	0.0	25	14	91
6/27	10:30	1	N 0-5	n.a.	0.0	21	14	88
6/27	17:00	1	N 5-10	n.a.	0.0	33	12	87
6/28	07:30	1	W 0-5	n.a.	0.0	15	15	79
6/28	17:00	2	SW 0-5	n.a.	0.0	25	20	77
6/29	07:30	4	0	F	9.0	15	8	73
6/29	17:00	2	W 0-5	n.a.	0.0	23	13	71
6/30	07:30	4	0	n.a.	0.5	15	9	68
6/30	17:00	2	W 0-5	n.a.	0.0	28	20	68
7/1	07:30	4	0	n.a.	0.0	15	13	67
7/1	17:00	4	0	n.a.	0.0	25	15	66

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Observation		Sky	Wind Direction	Precipitation		Temperature °C		Water
Date	Time	Code[a]	and Velocity (mph)	Code[b]	Amount (mm)	Air	Water	Level (cm)
7/2	07:30	4	0	n.a.	0.0	11	12	64
7/2	17:00	4	0	n.a.	0.0	21	13	63
7/3	10:30	4	0	n.a.	0.0	18	12	63
7/3	17:00	3	0	n.a.	0.0	23	14	62
7/4	10:30	4	0	A	2.0	15	12	61
7/4	17:00	2	0	n.a.	0.0	19	14	61
7/5	10:30	4	0	B	4.0	15	13	62
7/5	17:00	4	N 0-5	n.a.	0.0	19	14	63
7/6	07:30	1	0	A	2.0	12	10	68
7/6	17:00	2	W 0-5	n.a.	0.0	25	15	72
7/7	07:30	1	0	n.a.	0.0	15	14	72
7/7	17:00	4	N 0-10	n.a.	0.0	25	16	71
7/8	07:30	1	0	n.a.	0.0	12	11	67
7/8	17:00	2	0	n.a.	0.0	24	16	63
7/9	07:30	1	0	n.a.	0.0	11	12	63
7/9	17:00	2	0	n.a.	0.0	25	16	59
7/10	10:30	1	N 0-5	n.a.	0.0	20	14	58
7/10	17:00	1	0	n.a.	0.0	29	17	56
7/11	10:30	1	0	n.a.	0.0	20	14	54
7/11	17:00	1	0	n.a.	0.0	30	17	53
7/12	07:30	1	0	n.a.	0.0	12	11	52
7/12	17:00	1	SW 5-10	n.a.	0.0	29	18	51
7/13	07:30	1	0	n.a.	0.0	10	14	50
7/13	17:00	1	SW 0-5	n.a.	0.0	29	17	49
7/14	07:30	3	0	n.a.	0.0	9	14	49
7/14	17:00	4	N 0-5	n.a.	0.0	27	18	48
7/15	07:30	3	0	n.a.	0.0	13	13	47
7/15	17:00	3	SW 0-5	n.a.	0.0	24	16	47
7/16	07:30	4	0	A	0.0	13	13	46
7/16	17:00	3	V 0-5	n.a.	0.0	20	17	47
7/17	10:30	4	0	A	0.0	17	13	48
7/17	17:00	4	SW 0-5	n.a.	0.0	20	15	48
7/18	10:30	4	0	A	2.2	18	13	48
7/18	17:00	4	0	A	0.0	15	15	48
7/19	07:30	5	0	n.a.	0.0	12	13	48
7/19	17:00	2	WSW 0-5	n.a.	0.0	25	17	48
7/20	07:30	1	0	A	0.5	11	12	48
7/20	17:00	3	N 5-10	n.a.	0.0	16	15	48
7/21	07:30	4	NW 0-5	B	15.0	13	14	49
7/21	17:00	3	V 0-5	F	0.0	ND	ND	48
7/22	07:30	4	0	A	1.0	10	14	47
7/22	17:00	3	V 0-10	F	0.0	21	17	49
7/23	07:30	1	0	n.a.	0.0	8	13	48
7/23	17:00	3	W 0-5	n.a.	0.0	23	16	48
7/24	10:30	4	0	A	1.0	13	13	48
7/24	17:00	4	0	n.a.	0.0	20	15	48
7/25	10:30	1	0	A	3.0	15	11	49
7/25	17:00	3	N 0-5	n.a.	0.0	25	15	51

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Observation		Sky	Wind Direction	Precipitation		Temperature °C		Water
Date	Time	Code[a]	and Velocity (mph)	Code[b]	Amount (mm)	Air	Water	Level (cm)
7/26	07:30	4	0	A	1.0	11	13	64
7/26	17:00	4	W 0-5	n.a.	0.0	17	14	66
7/27	07:30	4	0	B	8.0	11	12	65
7/27	17:00	4	0	n.a.	0.0	18	13	63
7/28	07:30	3	0	n.a.	0.0	11	12	60
7/28	17:00	3	NW 0-5	n.a.	0.0	18	14	60
7/29	07:30	3	0	A	3.0	13	12	59
7/29	17:00	4	SW 0-5	n.a.	0.0	18	14	59
7/30	07:30	4	0	n.a.	0.0	11	11	62
7/31	07:30	5	0	n.a.	0.0	6	11	59
7/31	17:00	3	V 0-5	n.a.	0.0	24	15	57
8/1	10:30	3	N 0-5	n.a.	0.0	15	13	57
8/1	17:00	3	0	n.a.	0.0	16	14	57
8/2	07:30	1	0	n.a.	0.0	10	12	53
8/2	17:00	1	SW 0-5	n.a.	0.0	20	15	50
8/3	07:30	3	0	n.a.	0.0	8	13	50
8/3	17:00	4	0	n.a.	0.0	19	14	49
8/4	07:30	4	0	A	12.5	12	13	49
8/4	17:00	4	N 0-5	n.a.	0.0	15	13	49
8/5	07:30	4	0	A	1.0	13	13	52
8/5	17:00	3	WNW 0-5	n.a.	0.0	23	14	58
8/6	07:30	1	0	n.a.	0.0	5	10	60
8/6	17:00	1	0	n.a.	0.0	26	16	62
8/7	07:30	2	0	n.a.	0.0	6	10	61
8/7	17:00	4	V 0-5	n.a.	0.0	24	15	60
8/8	07:30	4	0	n.a.	0.0	14	11	56
8/8	17:00	1	S 5-10	n.a.	0.0	22	19	56
8/9	07:00	2	0	n.a.	0.0	10	14	52
8/9	17:00	2	NW 0-5	n.a.	0.0	24	17	51
8/10	07:15	3	0	n.a.	0.0	14	15	48
8/10	17:00	3	NE 0-5	n.a.	0.0	27	18	47
8/11	07:15	1	0	n.a.	0.0	9	15	46
8/11	17:00	4	SW 0-5	A	0.0	16	17	46
8/12	07:15	4	SE 0-5	F	12.5	13	15	46
8/12	17:00	2	NW 0-5	n.a.	0.0	23	16	46
8/13	07:40	3	0	n.a.	0.0	14	15	49
8/13	17:00	3	SW 0-5	n.a.	0.0	20	18	51
8/14	07:30	3	0	n.a.	0.0	7	14	49
8/14	17:00	3	SW 0-5	n.a.	0.0	20	15	48
8/15	10:30	4	0	n.a.	0.0	15	14	47
8/16	07:30	4	0	n.a.	0.0	9	14	46
8/16	17:00	2	0	n.a.	0.0	27	16	45
8/17	07:30	5	0	n.a.	0.0	7	14	44
8/17	17:00	2	0	n.a.	0.0	27	16	44
8/18	07:30	2	0	n.a.	0.0	9	14	43
8/18	17:00	1	S 5	n.a.	0.0	28	17	43
8/19	07:30	5	0	n.a.	0.0	8	14	42
8/19	17:00	1	0	n.a.	0.0	24	16	41

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Observation		Sky	Wind Direction	Precipitation		Temperature °C		Water
Date	Time	Code[a]	and Velocity (mph)	Code[b]	Amount (mm)	Air	Water	Level (cm)
8/20	07:30	4	0	n.a.	0.0	9	14	40
8/21	10:30	5	0	n.a.	0.0	13	14	39
8/22	10:30	5	0	n.a.	0.0	14	14	39
8/22	17:00	1	N 5	n.a.	0.0	24	16	39
8/23	07:30	5	0	n.a.	0.0	3	10	38
8/23	17:00	2	N 5	n.a.	0.0	29	15	38
8/24	07:30	1	0	n.a.	0.0	3	13	37
8/24	17:00	1	N 0-5	n.a.	0.0	26	15	38
8/25	07:30	1	0	n.a.	0.0	10	13	37
8/25	17:00	1	W 0-5	n.a.	0.0	20	14	37
8/26	07:30	1	N 0-5	n.a.	0.0	8	10	36
8/26	17:00	4	N 0-5	n.a.	0.0	10	11	36
8/27	07:30	4	0	n.a.	0.0	8	10	35
8/27	17:00	4	N 0-5	A	0.0	10	15	35
8/28	10:30	4	0	A	0.0	10	13	35
8/28	17:00	1	N 0-5	n.a.	0.0	19	14	35
8/29	10:30	1	0	n.a.	0.0	4	9	34
8/29	17:00	1	NW 0-5	n.a.	0.0	17	11	35
8/30	07:30	4	0	n.a.	0.0	5	10	35
8/30	17:00	4	0	n.a.	0.0	14	12	35
8/31	07:30	4	0	n.a.	0.0	8	10	34
8/31	17:00	4	0	n.a.	0.0	15	12	34
9/1	07:30	4	0	A	7.0	10	10	35
9/1	17:00	3	NW 0-5	n.a.	0.0	17	13	35
9/2	07:30	4	N 0-5	A	2.0	11	10	35
9/2	17:00	2	N 0-10	n.a.	0.0	16	12	36
9/3	07:30	4	0	A	0.5	5	9	37
9/3	17:00	3	NE 0-5	n.a.	0.0	17	12	37
9/4	10:30	1	0	n.a.	0.0	4	8	36
9/4	17:00	3	N 0-5	n.a.	0.0	15	10	36
9/5	10:30	4	0	A	0.5	10	9	34
9/5	17:00	4	0	n.a.	0.0	14	12	35
9/6	10:30	1	NW 0-5	n.a.	0.0	7	8	34
9/6	17:00	1	N 0-5	n.a.	0.0	14	10	34
9/7	07:30	2	0	n.a.	0.0	3	8	34
9/7	17:00	1	0	n.a.	0.0	19	14	34
9/8	10:30	1	0	n.a.	0.0	0	8	34
9/8	17:00	1	0	n.a.	0.0	19	11	34
9/9	10:30	1	0	n.a.	0.0	4	8	33
9/9	17:00	1	0	n.a.	0.0	18	12	33
9/10	10:30	2	0	n.a.	0.0	6	8	33
9/11	10:30	4	V 0-5	n.a.	0.0	9	8	33
9/11	17:00	1	N 0-5	n.a.	0.0	15	9	33
9/12	10:30	3	N 0-5	A	1.4	4	8	32
9/12	17:00	3	N 5-15	n.a.	0.0	11	12	32
9/13	10:30	3	0	A	0.2	4	6	32
9/13	17:00	3	0	n.a.	0.0	9	8	32
9/14	10:30	3	0	n.a.	0.3	3	6	32

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Observation		Sky	Wind Direction	Precipitation		Temperature °C		Water
Date	Time	Code[a]	and Velocity (mph)	Code[b]	Amount (mm)	Air	Water	Level (cm)
9/14	17:00	3	0	n.a.	0.0	9	7	32
9/15	10:30	3	0	n.a.	0.5	1	5	32
9/15	17:00	3	NW 5	n.a.	0.0	12	7	32
9/16	10:30	4	0	n.a.	0.0	3	6	32
9/16	17:00	3	N 5	n.a.	0.0	8	5	32
9/17	10:30	1	NW 5	n.a.	0.0	1	4	32
9/17	17:00	1	NW 15	n.a.	0.0	10	6	32
9/18	10:30	4	0	n.a.	0.0	2	4	31
9/18	17:00	4	NW 5	n.a.	0.0	10	5	31
9/19	10:30	4	0	B	2.7	5	4	31
9/19	17:00	4	0	B	0.0	9	5	33
9/20	10:30	4	0	A	13.5	5	5	34
9/20	17:00	4	N 5	n.a.	0.0	6	5	35
9/21	10:30	4	0	A	0.4	6	5	38

[a] Sky condition codes:
- 0 = no observation
- 1 = < 1/10 cloud cover
- 2 = partly cloudy; < 1/2 cloud cover
- 3 = mostly cloudy; > 1/2 cloud cover
- 4 = complete overcast
- 5 = thick fog
- ND = no data

[b] Precipitation Codes:
- A = intermittaent rain
- B = continuous rain
- C = snow
- D = snow and rain
- E = hail
- F = thunder
- n.a. = not applicable

APPENDIX E

Appendix E1.–Historical Chinook salmon passage at Tatlawiksuk River weir.

	Daily Passage							Daily Cumulative Passage						
Date	1998	1999	2000	2001	2002	2003	2004	1998	1999	2000	2001	2002	2003	2004
6/15	0 [a]	0	0	0 [a]	0 [a]	0 [a]	2	0	0	0	0	0	0	2
6/16	0 [a]	0	0	0 [a]	0 [a]	0 [a]	2	0	0	0	0	0	0	4
6/17	0 [a]	0	0	0 [a]	0 [b]	0 [a]	0	0	0	0	0	0	0	4
6/18	0	0	2	0 [a]	0	0 [a]	4	0	0	2	0	0	0	8
6/19	0	0	2	0 [a]	0	0 [a]	8	0	0	4	0	0	0	16
6/20	1	0	0	0	0	0	3	1	0	4	0	0	0	19
6/21	0	0	0	1	1	0	2	1	0	4	1	1	0	21
6/22	0	0	1	2	19	6	1	1	0	5	3	20	6	22
6/23	8	4	0	1	67	0	0	9	4	5	4	87	6	22
6/24	12	2	10	3	3	5	11	21	6	15	7	90	11	33
6/25	7	2	0	5	2	13	74	28	8	15	12	92	24	107
6/26	12	6	20	71	8	19	241	40	14	35	83	100	43	348
6/27	37	4	2	18	517	3	21	77	18	37	101	617	46	369
6/28	31	14	5	38	21	152	84	108	32	42	139	638	198	453
6/29	23	5	2	15	195	297	75	131	37	44	154	833	495	528
6/30	5	2	22	105	25	57	43	136	39	66	259	858	552	571
7/01	99	16	26	364	15	41	315	235	55	92	623	873	593	886
7/02	182	5	149	24	84	8	131	417	60	241	647	957	601	1,017
7/03	171	13	47	27	108	96 [a]	86	588	73	288	674	1,065	697	1,103
7/04	224	26	30	13	135	29 [a]	165	812	99	318	687	1,200	726	1,268
7/05	74	14	42	111	338	59 [a]	243	886	113	360	798	1,538	786	1,511
7/06	62	15	17	428	64	42 [a]	7	948	128	377	1,226	1,602	827	1,518
7/07	22 [c]	14	18	170	145	13 [a]	84	970	142	395	1,396	1,747	841	1,602
7/08	[d]	13	13	21	10	27 [a]	106	n.a.	155	408	1,417	1,757	868	1,708
7/09	[d]	21	73	29	24	129 [a]	229	n.a.	176	481	1,446	1,781	997	1,937
7/10	[d]	40	51	29	27	35 [a]	165	n.a.	216	532	1,475	1,808	1,033	2,102
7/11	[d]	79 [e]	45	14	48	35 [a]	43	n.a.	295	577	1,489	1,856	1,068	2,145
7/12	[d]	118	50	48	19	34 [a]	16	n.a.	413	627	1,537	1,875	1,102	2,161
7/13	[d]	54	9	150	20	88 [a]	98	n.a.	467	636	1,687	1,895	1,190	2,259
7/14	[d]	64	0	48	21	65 [a]	29	n.a.	531	636	1,735	1,916	1,255	2,288
7/15	[d]	24	8	47	103	38 [a]	31	n.a.	555	644	1,782	2,019	1,293	2,319
7/16	[d]	65	20	12	10	28 [a]	47	n.a.	620	664	1,794	2,029	1,321	2,366
7/17	[d]	6	47	19	15	18 [a]	161	n.a.	626	711	1,813	2,044	1,339	2,527
7/18	[d]	146	5	31	3	22 [a]	53	n.a.	772	716	1,844	2,047	1,361	2,580
7/19	[d]	20	8	36	15	30 [a]	17	n.a.	792	724	1,880	2,062	1,390	2,597

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	Daily Passage							Daily Cumulative Passage						
Date	1998	1999	2000	2001	2002	2003	2004	1998	1999	2000	2001	2002	2003	2004
7/20	[d]	381	10	17	8	72 [a]	12	n.a.	1,173	734	1,897	2,070	1,462	2,609
7/21	[d]	18	2	8	14	9 [a]	22	n.a.	1,191	736	1,905	2,084	1,471	2,631
7/22	[d]	9	16	21	29	15 [a]	21	n.a.	1,200	752	1,926	2,113	1,486	2,652
7/23	[d]	86	7	11	13	17 [a]	26	n.a.	1,286	759	1,937	2,126	1,503	2,678
7/24	[d]	46	5	13 [a]	7	25 [a]	19	n.a.	1,332	764	1,950	2,133	1,528	2,697
7/25	[d]	33	8	9 [a]	18	16 [a]	13	n.a.	1,365	772	1,959	2,151	1,544	2,710
7/26	[d]	18	2	6	4	14 [a]	14	n.a.	1,383	774	1,965	2,155	1,558	2,724
7/27	[d]	14 [e]	3	5 [a]	24	14 [a]	26	n.a.	1,397	777	1,970	2,179	1,572	2,750
7/28	[d]	10	1	2	20	16 [a]	19	n.a.	1,407	778	1,972	2,199	1,588	2,769
7/29	[d]	22	1	8	10	13 [a]	9	n.a.	1,429	779	1,980	2,209	1,602	2,778
7/30	[d]	15	6	3	5	8 [a]	2	n.a.	1,444	785	1,983	2,214	1,610	2,780
7/31	[d]	6	1	5 [a]	6	16 [a]	15	n.a.	1,450	786	1,988	2,220	1,627	2,795
8/01	[d]	6	2	4 [a]	1	6 [a]	0	n.a.	1,456	788	1,992	2,221	1,632	2,795
8/02	[d]	1	3 [a]	3 [a]	5	8 [a]	1	n.a.	1,457	791	1,995	2,226	1,640	2,796
8/03	[d]	4	8	2 [a]	0	6 [a]	2	n.a.	1,461	799	1,997	2,226	1,646	2,798
8/04	[d]	3	2	2	1	2 [a]	4	n.a.	1,464	801	1,999	2,227	1,648	2,802
8/05	[d]	5	0	1	0	2 [a]	6	n.a.	1,469	801	2,000	2,227	1,650	2,808
8/06	[d]	3	1	1	0	4 [a]	5	n.a.	1,472	802	2,001	2,227	1,653	2,813
8/07	[d]	2	1	2	1	2 [a]	3	n.a.	1,474	803	2,003	2,228	1,656	2,816
8/08	[d]	4	3	2	0	2 [a]	4	n.a.	1,478	806	2,005	2,228	1,658	2,820
8/09	[d]	0	1	0	1	2 [a]	0	n.a.	1,478	807	2,005	2,229	1,660	2,820
8/10	[d]	1 [a]	1	1	0	2 [a]	2	n.a.	1,479	808	2,006	2,229	1,661	2,822
8/11	[d]	1 [a]	1	0	0	1 [a]	3	n.a.	1,480	809	2,006	2,229	1,662	2,825
8/12	[d]	1 [a]	0	2	1	3 [a]	0	n.a.	1,481	809	2,008	2,230	1,665	2,825
8/13	[d]	1 [a]	1	1	0	3 [a]	1	n.a.	1,482	810	2,009	2,230	1,668	2,826
8/14	[d]	1 [a]	2 [a]	0	0	2 [a]	0	n.a.	1,483	812	2,009	2,230	1,670	2,826
8/15	[d]	1 [a]	1 [a]	0	2	1 [a]	0	n.a.	1,484	814	2,009	2,232	1,671	2,826
8/16	[d]	1 [a]	1 [a]	0	0	1 [a]	1	n.a.	1,485	814	2,009	2,232	1,673	2,827
8/17	[d]	1 [a]	0 [a]	0 [a]	0	1 [a]	0	n.a.	1,486	814	2,009	2,232	1,674	2,827
8/18	[d]	1 [a]	0 [a]	0 [a]	0	1 [a]	0	n.a.	1,487	815	2,009	2,232	1,675	2,827
8/19	[d]	1 [a]	1 [a]	0 [a]	1	1 [a]	0	n.a.	1,488	815	2,009	2,233	1,676	2,827
8/20	[d]	0 [a]	0 [a]	0 [a]	0	2 [a]	0	n.a.	1,488	815	2,009	2,233	1,678	2,827
8/21	[d]	0 [a]	0 [a]	0 [a]	1	1 [a]	3	n.a.	1,488	815	2,009	2,234	1,679	2,830
8/22	[d]	0 [a]	0 [a]	0 [a]	0	1 [a]	0	n.a.	1,488	816	2,009	2,234	1,680	2,830
8/23	[d]	0 [a]	1 [a]	0 [a]	0	1 [a]	1	n.a.	1,488	816	2,009	2,234	1,680	2,831

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Date	Daily Passage 1998	1999	2000	2001	2002	2003	2004	Daily Cumulative Passage 1998	1999	2000	2001	2002	2003	2004
8/24	[d]	0	0 [a]	0 [a]	0	1 [a]	0	n.a.	1,488	816	2,009	2,234	1,681	2,831
8/25	[d]	1	0 [a]	0 [a]	0	0 [a]	0	n.a.	1,489	816	2,009	2,234	1,681	2,831
8/26	[d]	0 [a]	1 [a]	0 [a]	0	0 [a]	0	n.a.	1,489	817	2,009	2,234	1,682	2,831
8/27	[d]	0	0 [a]	2 [a]	0	0 [a]	0	n.a.	1,489	817	2,011	2,234	1,682	2,831
8/28	[d]	0	0 [a]	0	0	0 [a]	0	n.a.	1,489	817	2,011	2,234	1,682	2,831
8/29	[d]	0	0 [a]	0	0	0 [a]	1	n.a.	1,489	817	2,011	2,234	1,682	2,832
8/30	[d]	0	0 [a]	0	0	0 [a]	0	n.a.	1,489	817	2,011	2,234	1,682	2,832
8/31	[d]	0	0 [a]	0	0	0 [a]	0	n.a.	1,489	817	2,011	2,234	1,682	2,832
9/01	[d]	0	0 [a]	0	0	0 [a]	0	n.a.	1,489	817	2,011	2,234	1,682	2,832
9/02	[d]	1	0 [a]	0	0	0 [a]	1	n.a.	1,490	817	2,011	2,234	1,682	2,833
9/03	[d]	0	0 [a]	0	1	0 [a]	0	n.a.	1,490	817	2,011	2,235	1,682	2,833
9/04	[d]	0	0 [a]	0	0	0 [a]	0	n.a.	1,490	817	2,011	2,235	1,683	2,833
9/05	[d]	0	0 [a]	0	0	0 [a]	0	n.a.	1,490	817	2,011	2,235	1,683	2,833
9/06	[d]	0	0 [a]	0	0	0 [a]	0	n.a.	1,490	817	2,011	2,235	1,683	2,833
9/07	[d]	0	0 [a]	0	1	0 [a]	0	n.a.	1,490	817	2,011	2,236	1,683	2,833
9/08	[d]	0	0 [a]	0	0	0 [a]	0	n.a.	1,490	817	2,011	2,236	1,683	2,833
9/09	[d]	0	0 [a]	0	1	0 [a]	0	n.a.	1,490	817	2,011	2,237	1,683	2,833
9/10	[d]	0	0 [a]	0	0	0 [a]	0	n.a.	1,490	817	2,011	2,237	1,683	2,833
9/11	[d]	0	0 [a]	0	0	0 [a]	0	n.a.	1,490	817	2,011	2,237	1,683	2,833
9/12	[d]	0	0 [a]	0	0 [b]	0 [a]	0	n.a.	1,490	817	2,011	2,237	1,683	2,833
9/13	[d]	0	0 [a]	0	0 [a]	0 [a]	0	n.a.	1,490	817	2,011	2,237	1,683	2,833
9/14	[d]	0	0 [a]	0	0 [a]	0 [a]	0	n.a.	1,490	817	2,011	2,237	1,683	2,833
9/15	[d]	0	0 [a]	0	0 [a]	0 [a]	0	n.a.	1,490	817	2,011	2,237	1,683	2,833
9/16	[d]	0	0 [a]	0 [a]	0 [a]	0 [a]	0	n.a.	1,490	817	2,011	2,237	1,683	2,833
9/17	[d]	0	0 [a]	0 [a]	0 [a]	0 [a]	0	n.a.	1,490	817	2,011	2,237	1,683	2,833
9/18	[d]	0	0 [a]	0 [a]	0 [a]	0 [a]	0	n.a.	1,490	817	2,011	2,237	1,683	2,833
9/19	[d]	0	0 [a]	0 [a]	0 [a]	0 [a]	0 [a]	n.a.	1,490	817	2,011	2,237	1,683	2,833
9/20	[d]	0	0 [a]	0 [a]	0 [b]	0 [a]	0 [a]	n.a.	1,490	817	2,011	2,237	1,683	2,833
Total	970	1,490	817	2,011	2,237	1,683	2,833							
Observed	970	1,413	807	1,973	2,237	601	2,833							
% Estimated	n.a.	5.2	1.3	1.9	0.0	64.3	0.0							

Note: n.a. = Not applicable.

[a] The weir was not operational; daily passage was estimated.

[b] Partial day count, passage was estimated.

[c] Partial day count, passage was not estimated.

[d] The weir was not operational; daily passage was not estimated.

[e] Daily passage was estimated due to the occurrence of a hole in the weir.

Appendix E2.–Historical chum salmon passage at Tatlawiksuk River weir.

	Daily Passage							Daily Cumulative Passage						
Date	1998	1999	2000	2001	2002	2003	2004	1998	1999	2000	2001	2002	2003	2004
6/15	0 [a]	0	1	0 [a]	1 [a]	0 [a]	9	0	0	1	0	1		9
6/16	0 [a]	0	1	0 [a]	2 [a]	0 [a]	15	0	0	2	0	3		24
6/17	0 [a]	0	0	0 [a]	4 [b]	0 [a]	7	0	0	2	0	7		31
6/18	0	0	2	0 [a]	2	0 [a]	22	0	0	4	0	9		53
6/19	0	0	0	0 [a]	6	0 [a]	75	0	0	4	0	15		128
6/20	0	0	0	0	3	0	105	0	0	4	0	18	0	233
6/21	5	0	2	3	42	0	53	5	0	6	3	60	0	286
6/22	4	0	7	4	168	1	81	9	0	13	7	228	1	367
6/23	12	0	1	30	262	5	71	21	0	14	37	490	6	438
6/24	25	18	18	22	28	6	169	46	18	32	59	518	12	607
6/25	26	7	30	61	103	4	594	72	25	62	120	621	16	1,201
6/26	65	18	97	131	483	12	450	137	43	159	251	1,104	28	1,651
6/27	197	25	7	69	392	20	175	334	68	166	320	1,496	48	1,826
6/28	275	67	10	143	574	106	176	609	135	176	463	2,070	154	2,002
6/29	195	67	3	133	834	71	266	804	202	179	596	2,904	225	2,268
6/30	146	58	88	368	634	135	378	950	260	267	964	3,538	360	2,646
7/01	464	91	176	440	424	78	462	1,414	351	443	1,404	3,962	438	3,108
7/02	529	86	492	143	1,037	41	690	1,943	437	935	1,547	4,999	479	3,798
7/03	556	101	280	171	501	[c]	660	2,499	538	1,215	1,718	5,500	n.a.	4,458
7/04	1,005	110	147	162	759	[c]	525	3,504	648	1,362	1,880	6,259	n.a.	4,983
7/05	1,011	94	325	488	1,278	[c]	482	4,515	742	1,687	2,368	7,537	n.a.	5,465
7/06	757	141	155	618	1,762	[c]	235	5,272	883	1,842	2,986	9,299	n.a.	5,700
7/07	454	171	175	778	809	[c]	638	5,726	1,054	2,017	3,764	10,108	n.a.	6,338
7/08	[c]	158	109	900	666	[c]	811	n.a.	1,212	2,126	4,664	10,774	n.a.	7,149
7/09	[c]	324	462	1,061	840	[c]	836	n.a.	1,536	2,588	5,725	11,614	n.a.	7,985
7/10	[c]	391	247	1,399	828	[c]	627	n.a.	1,927	2,835	7,124	12,442	n.a.	8,612
7/11	[c]	404 [d]	391	596	1,238	[c]	425	n.a.	2,331	3,226	7,720	13,680	n.a.	9,037
7/12	[c]	416	611	1,179	869	[c]	502	n.a.	2,747	3,837	8,899	14,549	n.a.	9,539
7/13	[c]	280	169	1,199	702	[c]	967	n.a.	3,027	4,006	10,098	15,251	n.a.	10,506
7/14	[c]	361	33	1,301	707	[c]	759	n.a.	3,388	4,039	11,399	15,958	n.a.	11,265
7/15	[c]	268	266	1,330	1,123	[c]	642	n.a.	3,656	4,305	12,729	17,081	n.a.	11,907
7/16	[c]	377	367	1,092	677	[c]	829	n.a.	4,033	4,672	13,821	17,758	n.a.	12,736
7/17	[c]	339	257	1,201	959	[c]	863	n.a.	4,372	4,929	15,022	18,717	n.a.	13,599
7/18	[c]	404	183	1,607	880	[c]	800	n.a.	4,776	5,112	16,629	19,597	n.a.	14,399
7/19	[c]	160	144	859	707	[c]	655	n.a.	4,936	5,256	17,488	20,304	n.a.	15,054

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Date	Daily Passage							Daily Cumulative Passage						
	1998	1999	2000	2001	2002	2003	2004	1998	1999	2000	2001	2002	2003	2004
7/20	[c]	663	88	699	468	[c]	573	n.a.	5,599	5,344	18,187	20,772	n.a.	15,627
7/21	[c]	306	176	761	504	[c]	557	n.a.	5,905	5,520	18,948	21,276	n.a.	16,184
7/22	[c]	275	238	650	515	[c]	495	n.a.	6,180	5,758	19,598	21,791	n.a.	16,679
7/23	[c]	628	158	614	409	[c]	513	n.a.	6,808	5,916	20,212	22,200	n.a.	17,192
7/24	[c]	322	152	511 [a]	251	[c]	463	n.a.	7,130	6,068	20,723	22,451	n.a.	17,655
7/25	[c]	338	114	391 [a]	206	[c]	474	n.a.	7,468	6,182	21,114	22,657	n.a.	18,129
7/26	[c]	205	85	270	195	[c]	359	n.a.	7,673	6,267	21,384	22,852	n.a.	18,488
7/27	[c]	214 [d]	122	206 [a]	301	[c]	421	n.a.	7,886	6,389	21,590	23,153	n.a.	18,909
7/28	[c]	222	93	169	224	[c]	344	n.a.	8,108	6,482	21,759	23,377	n.a.	19,253
7/29	[c]	130	94	178	159	[c]	304	n.a.	8,238	6,576	21,937	23,536	n.a.	19,557
7/30	[c]	285	141	230	144	[c]	123	n.a.	8,523	6,717	22,167	23,680	n.a.	19,680
7/31	[c]	141	72	190 [a]	119	[c]	322	n.a.	8,664	6,789	22,357	23,799	n.a.	20,002
8/01	[c]	171	41	176 [a]	99	[c]	151	n.a.	8,835	6,830	22,533	23,898	n.a.	20,153
8/02	[c]	125	37 [a]	163 [a]	59	[c]	124	n.a.	8,960	6,867	22,696	23,957	n.a.	20,277
8/03	[c]	141	18	149 [a]	54	[c]	85	n.a.	9,101	6,885	22,845	24,011	n.a.	20,362
8/04	[c]	60	15	131	64	[c]	93	n.a.	9,161	6,900	22,976	24,075	n.a.	20,455
8/05	[c]	57	8	139	98	[c]	117	n.a.	9,218	6,908	23,115	24,173	n.a.	20,572
8/06	[c]	35	9	96	44	[c]	87	n.a.	9,253	6,917	23,211	24,217	n.a.	20,659
8/07	[c]	43	12	95	55	[c]	99	n.a.	9,296	6,929	23,306	24,272	n.a.	20,758
8/08	[c]	24	5	62	72	[c]	134	n.a.	9,320	6,934	23,368	24,344	n.a.	20,892
8/09	[c]	42	2	69	30	[c]	43	n.a.	9,362	6,936	23,437	24,374	n.a.	20,935
8/10	[c]	30 [a]	5	36	37	[c]	44	n.a.	9,392	6,941	23,473	24,411	n.a.	20,979
8/11	[c]	28 [a]	7	38	22	[c]	45	n.a.	9,420	6,948	23,511	24,433	n.a.	21,024
8/12	[c]	26 [a]	8	38	25	[c]	26	n.a.	9,446	6,956	23,549	24,458	n.a.	21,050
8/13	[c]	24 [a]	9	27	13	[c]	13	n.a.	9,470	6,965	23,576	24,471	n.a.	21,063
8/14	[c]	22 [a]	10 [a]	19	5	[c]	22	n.a.	9,492	6,975	23,595	24,476	n.a.	21,085
8/15	[c]	20 [a]	4 [a]	23	13	[c]	19	n.a.	9,512	6,979	23,618	24,489	n.a.	21,104
8/16	[c]	17 [a]	4 [a]	8	8	[c]	14	n.a.	9,529	6,983	23,626	24,497	n.a.	21,118
8/17	[c]	15 [a]	4 [a]	14 [a]	8	[c]	7	n.a.	9,544	6,987	23,640	24,505	n.a.	21,125
8/18	[c]	13 [a]	2 [a]	13 [a]	15	[c]	5	n.a.	9,557	6,989	23,653	24,520	n.a.	21,130
8/19	[c]	11 [a]	6 [a]	12 [a]	1	[c]	14	n.a.	9,568	6,995	23,665	24,521	n.a.	21,144
8/20	[c]	9 [a]	14 [a]	11 [a]	2	[c]	20	n.a.	9,577	7,009	23,675	24,523	n.a.	21,164
8/21	[c]	7 [a]	8 [a]	9 [a]	1	[c]	9	n.a.	9,584	7,017	23,684	24,524	n.a.	21,173
8/22	[c]	4 [a]	0 [a]	8 [a]	2	[c]	12	n.a.	9,588	7,017	23,692	24,526	n.a.	21,185
8/23	[c]	1 [a]	2 [a]	7 [a]	0	[c]	9	n.a.	9,589	7,019	23,699	24,526	n.a.	21,194

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	Daily Passage							Daily Cumulative Passage						
Date	1998	1999	2000	2001	2002	2003	2004	1998	1999	2000	2001	2002	2003	2004
8/24	[c]	1	0 [a]	6 [a]	2	[c]	4	n.a.	9,590	7,019	23,705	24,528	n.a.	21,198
8/25	[c]	0	6 [a]	4 [a]	2	[c]	7	n.a.	9,590	7,025	23,709	24,530	n.a.	21,205
8/26	[c]	2 [d]	2 [a]	3 [a]	2	[c]	5	n.a.	9,592	7,027	23,712	24,532	n.a.	21,210
8/27	[c]	2	2 [a]	2 [a]	0	[c]	4	n.a.	9,594	7,029	23,714	24,532	n.a.	21,214
8/28	[c]	0	2 [a]	1	0	[c]	3	n.a.	9,594	7,031	23,715	24,532	n.a.	21,217
8/29	[c]	0	2 [a]	0	2	[c]	3	n.a.	9,594	7,033	23,715	24,534	n.a.	21,220
8/30	[c]	0	2 [a]	0	1	[c]	0	n.a.	9,594	7,035	23,715	24,535	n.a.	21,220
8/31	[c]	1	0 [a]	0	2	[c]	1	n.a.	9,595	7,035	23,715	24,537	n.a.	21,221
9/01	[c]	0	4 [a]	0	2	[c]	6	n.a.	9,595	7,039	23,715	24,539	n.a.	21,227
9/02	[c]	1	0 [a]	2	1	[c]	0	n.a.	9,596	7,039	23,717	24,540	n.a.	21,227
9/03	[c]	0	2 [a]	1	0	[c]	2	n.a.	9,596	7,041	23,718	24,540	n.a.	21,229
9/04	[c]	0	0 [a]	0	0	[c]	2	n.a.	9,596	7,041	23,718	24,540	n.a.	21,231
9/05	[c]	1	2 [a]	0	1	[c]	1	n.a.	9,597	7,044	23,718	24,541	n.a.	21,232
9/06	[c]	2	0 [a]	0	0	[c]	2	n.a.	9,599	7,044	23,718	24,541	n.a.	21,234
9/07	[c]	0	0 [a]	0	0	[c]	3	n.a.	9,599	7,044	23,718	24,541	n.a.	21,237
9/08	[c]	0	0 [a]	0	0	[c]	0	n.a.	9,599	7,044	23,718	24,541	n.a.	21,237
9/09	[c]	0	0 [a]	0	0	[c]	0	n.a.	9,599	7,044	23,718	24,541	n.a.	21,237
9/10	[c]	0	0 [a]	0	0	[c]	0	n.a.	9,599	7,044	23,718	24,541	n.a.	21,237
9/11	[c]	0	0 [a]	0	0	[c]	2	n.a.	9,599	7,044	23,718	24,541	n.a.	21,239
9/12	[c]	0	0 [a]	0	1 [b]	[c]	1	n.a.	9,599	7,044	23,718	24,542	n.a.	21,240
9/13	[c]	0	0 [a]	0	0 [a]	[c]	1	n.a.	9,599	7,044	23,718	24,542	n.a.	21,241
9/14	[c]	0	0 [a]	0	0 [a]	[c]	1	n.a.	9,599	7,044	23,718	24,542	n.a.	21,242
9/15	[c]	0	0 [a]	0	0 [a]	[c]	2	n.a.	9,599	7,044	23,718	24,542	n.a.	21,244
9/16	[c]	0	0 [a]	0 [a]	0 [a]	[c]	1	n.a.	9,599	7,044	23,718	24,542	n.a.	21,245
9/17	[c]	0	0 [a]	0 [a]	0 [a]	[c]	0	n.a.	9,599	7,044	23,718	24,542	n.a.	21,245
9/18	[c]	0	0 [a]	0 [a]	0 [a]	[c]	0	n.a.	9,599	7,044	23,718	24,542	n.a.	21,245
9/19	[c]	0	0 [a]	0 [a]	0 [a]	[c]	0 [a]	n.a.	9,599	7,044	23,718	24,542	n.a.	21,245
9/20	[c]	0	0 [a]	0 [a]	0 [b]	[c]	0 [a]	n.a.	9,599	7,044	23,718	24,542	n.a.	21,245
Total	5,726	9,599	7,044	23,718	24,542	479	21,245							
Observed	5,726	9,147	6,928	22,109	24,539	479	21,245							
% Estimated	n.a.	4.7	1.6	6.8	0.0	n.a.	0.0							

Note: n.a. = Not applicable.

[a] The weir was not operational; daily passage was estimated.

[b] Partial day count, passage was estimated.

[c] The weir was not operational; daily passage was not estimated.

[d] Daily passage was estimated due to the occurrence of a hole in the weir.

Appendix E3.–Historical coho salmon passage at Tatlawiksuk River weir.

	Daily Passage							Daily Cumulative Passage						
Date	1998	1999	2000	2001	2002	2003	2004	1998	1999	2000	2001	2002	2003	2004
6/15	0 [a]	0	0	0	0 [a]	0 [a]	0	-	0	0	0	0	-	0
6/16	0 [a]	0	0	0	0 [a]	0 [a]	0	-	0	0	0	0	-	0
6/17	0 [a]	0	0	0	0 [b]	0 [a]	0	-	0	0	0	0	-	0
6/18	0	0	0	0	0	0 [a]	0	0	0	0	0	0	-	0
6/19	0	0	0	0	0	0 [a]	0	0	0	0	0	0	-	0
6/20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/27	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/29	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/03	0	0	0	0	0	[c]	0	0	0	0	0	0	n.a.	0
7/04	0	0	0	0	0	[c]	0	0	0	0	0	0	n.a.	0
7/05	0	0	0	0	0	[c]	0	0	0	0	0	0	n.a.	0
7/06	0	0	0	0	0	[c]	0	0	0	0	0	0	n.a.	0
7/07	0	0	0	0	0	[c]	0	0	0	0	0	0	n.a.	0
7/08	[c]	0	0	0	0	[c]	0	n.a.	0	0	0	0	n.a.	0
7/09	[c]	0	0	0	0	[c]	0	n.a.	0	0	0	0	n.a.	0
7/10	[c]	0	0	0	0	[c]	0	n.a.	0	0	0	0	n.a.	0
7/11	[c]	0 [d]	0	0	0	[c]	0	n.a.	0	0	0	0	n.a.	0
7/12	[c]	0	0	0	0	[c]	0	n.a.	0	0	0	0	n.a.	0
7/13	[c]	0	0	0	0	[c]	0	n.a.	0	0	0	0	n.a.	0
7/14	[c]	0	0	0	0	[c]	0	n.a.	0	0	0	0	n.a.	0
7/15	[c]	0	0	0	0	[c]	0	n.a.	0	0	0	0	n.a.	0
7/16	[c]	0	0	0	0	[c]	0	n.a.	0	0	0	0	n.a.	0
7/17	[c]	0	0	0	0	[c]	0	n.a.	0	0	0	0	n.a.	0
7/18	[c]	0	0	0	0	[c]	0	n.a.	0	0	0	0	n.a.	0
7/19	[c]	0	2	0	0	[c]	0	n.a.	0	2	0	0	n.a.	0

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	Daily Passage							Daily Cumulative Passage						
Date	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
7/20	[c]	0	0	0	0	[c]	1	n.a.	0	2	0	0	n.a.	1
7/21	[c]	0	1	0	0	[c]	0	n.a.	0	3	0	0	n.a.	1
7/22	[c]	0	0	0	0	[c]	3	n.a.	0	3	0	0	n.a.	4
7/23	[c]	0	0	0	0	[c]	6	n.a.	0	3	0	0	n.a.	10
7/24	[c]	0	1	0 [a]	0	[c]	7	n.a.	0	4	0	0	n.a.	17
7/25	[c]	1	0	0 [a]	0	[c]	3	n.a.	1	4	0	0	n.a.	20
7/26	[c]	0	0	0	0	[c]	19	n.a.	1	4	0	0	n.a.	39
7/27	[c]	1 [d]	0	0 [a]	3	[c]	31	n.a.	2	4	0	3	n.a.	70
7/28	[c]	2	3	1	3	[c]	22	n.a.	4	7	1	6	n.a.	92
7/29	[c]	9	2	0	3	[c]	18	n.a.	13	9	1	9	n.a.	110
7/30	[c]	1	25	8	8	[c]	15	n.a.	14	34	9	17	n.a.	125
7/31	[c]	1	11	18 [a]	3	[c]	106	n.a.	15	45	27	20	n.a.	231
8/01	[c]	0	40	42 [a]	5	[c]	55	n.a.	15	85	69	25	n.a.	286
8/02	[c]	0	110 [a]	29 [a]	11	[c]	93	n.a.	15	195	98	36	n.a.	379
8/03	[c]	0	172	17 [a]	16	[c]	98	n.a.	15	367	114	52	n.a.	477
8/04	[c]	0	215	42	4	[c]	128	n.a.	15	582	156	56	n.a.	605
8/05	[c]	2	173	91	33	[c]	214	n.a.	17	755	247	89	n.a.	819
8/06	[c]	0	129	47	23	[c]	452	n.a.	17	884	294	112	n.a.	1,271
8/07	[c]	5	277	74	46	[c]	468	n.a.	22	1,161	368	158	n.a.	1,739
8/08	[c]	1	108	135	43	[c]	437	n.a.	23	1,269	503	201	n.a.	2,176
8/09	[c]	1	267	130	79	[c]	497	n.a.	24	1,536	633	280	n.a.	2,673
8/10	[c]	3 [a]	619	264	73	[c]	536	n.a.	27	2,155	897	353	n.a.	3,209
8/11	[c]	5 [a]	730	212	63	[c]	450	n.a.	32	2,885	1,109	416	n.a.	3,659
8/12	[c]	2 [a]	1,123	306	437	[c]	722	n.a.	33	4,008	1,415	853	n.a.	4,381
8/13	[c]	9 [a]	1,429	314	787	[c]	534	n.a.	42	5,437	1,729	1,640	n.a.	4,915
8/14	[c]	12 [a]	319 [e]	864	240	[c]	646	n.a.	54	5,756	2,593	1,880	n.a.	5,561
8/15	[c]	13 [a]	[c]	530	220	[c]	628	n.a.	67	n.a.	3,123	2,100	n.a.	6,189
8/16	[c]	27 [a]	[c]	860	345	[c]	515	n.a.	94	n.a.	3,983	2,445	n.a.	6,704
8/17	[c]	37 [a]	[c]	652 [a]	53	[c]	575	n.a.	129	n.a.	4,635	2,498	n.a.	7,279
8/18	[c]	45 [a]	[c]	610 [a]	349	[c]	591	n.a.	173	n.a.	5,245	2,847	n.a.	7,870
8/19	[c]	26 [a]	[c]	567 [a]	27	[c]	716	n.a.	199	n.a.	5,812	2,874	n.a.	8,586
8/20	[c]	72 [a]	[c]	525 [a]	28	[c]	395	n.a.	270	n.a.	6,337	2,902	n.a.	8,981
8/21	[c]	75 [a]	[c]	482 [a]	1,199	[c]	708	n.a.	343	n.a.	6,819	4,101	n.a.	9,689
8/22	[c]	33 [a]	[c]	439 [a]	420	[c]	825	n.a.	375	n.a.	7,258	4,521	n.a.	10,514
8/23	[c]	57 [a]	[c]	397 [a]	1,347	[c]	679	n.a.	446	n.a.	7,655	5,868	n.a.	11,193

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	Daily Passage							Daily Cumulative Passage						
Date	1998	1999	2000	2001	2002	2003	2004	1998	1999	2000	2001	2002	2003	2004
8/24	[c]	103	[c]	354 [a]	1,027	[c]	473	n.a.	549	n.a.	8,009	6,895	n.a.	11,666
8/25	[c]	88	[c]	311 [a]	542	[c]	638	n.a.	637	n.a.	8,320	7,437	n.a.	12,304
8/26	[c]	93 [d]	[c]	269 [a]	750	[c]	266	n.a.	730	n.a.	8,589	8,187	n.a.	12,570
8/27	[c]	97	[c]	226 [a]	354	[c]	304	n.a.	827	n.a.	8,815	8,541	n.a.	12,874
8/28	[c]	181	[c]	185	345	[c]	259	n.a.	1,008	n.a.	9,000	8,886	n.a.	13,133
8/29	[c]	171	[c]	182	106	[c]	246	n.a.	1,179	n.a.	9,182	8,992	n.a.	13,379
8/30	[c]	93	[c]	204	52	[c]	238	n.a.	1,272	n.a.	9,386	9,044	n.a.	13,617
8/31	[c]	184	[c]	176	368	[c]	284	n.a.	1,456	n.a.	9,562	9,412	n.a.	13,901
9/01	[c]	239	[c]	64	409	[c]	507	n.a.	1,695	n.a.	9,626	9,821	n.a.	14,408
9/02	[c]	170	[c]	87	225	[c]	260	n.a.	1,865	n.a.	9,713	10,046	n.a.	14,668
9/03	[c]	140	[c]	107	92	[c]	281	n.a.	2,005	n.a.	9,820	10,138	n.a.	14,949
9/04	[c]	190	[c]	88	182	[c]	183	n.a.	2,195	n.a.	9,908	10,320	n.a.	15,132
9/05	[c]	193	[c]	80	201	[c]	88	n.a.	2,388	n.a.	9,988	10,521	n.a.	15,220
9/06	[c]	103	[c]	33	79	[c]	137	n.a.	2,491	n.a.	10,021	10,600	n.a.	15,357
9/07	[c]	30	[c]	43	253	[c]	117	n.a.	2,521	n.a.	10,064	10,853	n.a.	15,474
9/08	[c]	35	[c]	55	40	[c]	134	n.a.	2,556	n.a.	10,119	10,893	n.a.	15,608
9/09	[c]	53	[c]	38	62	[c]	119	n.a.	2,609	n.a.	10,157	10,955	n.a.	15,727
9/10	[c]	303	[c]	13	54	[c]	123	n.a.	2,912	n.a.	10,170	11,009	n.a.	15,850
9/11	[c]	81	[c]	61	53	[c]	149	n.a.	2,993	n.a.	10,231	11,062	n.a.	15,999
9/12	[c]	81	[c]	29	51 [b]	[c]	95	n.a.	3,074	n.a.	10,260	11,113	n.a.	16,094
9/13	[c]	99	[c]	30	45 [a]	[c]	114	n.a.	3,173	n.a.	10,290	11,158	n.a.	16,208
9/14	[c]	82	[c]	38	40 [a]	[c]	85	n.a.	3,255	n.a.	10,328	11,198	n.a.	16,293
9/15	[c]	51	[c]	56	36 [a]	[c]	68	n.a.	3,306	n.a.	10,384	11,234	n.a.	16,361
9/16	[c]	26	[c]	39 [a]	31 [a]	[c]	19	n.a.	3,332	n.a.	10,423	11,265	n.a.	16,380
9/17	[c]	32	[c]	31 [a]	27 [a]	[c]	23	n.a.	3,364	n.a.	10,454	11,292	n.a.	16,403
9/18	[c]	18	[c]	24 [a]	22 [a]	[c]	7	n.a.	3,382	n.a.	10,478	11,314	n.a.	16,410
9/19	[c]	56	[c]	16 [a]	18 [a]	[c]	0 [a]	n.a.	3,438	n.a.	10,493	11,332	n.a.	16,410
9/20	[c]	17	[c]	8 [a]	13 [b]	[c]	0 [a]	n.a.	3,455	n.a.	10,501	11,345	n.a.	16,410
Total	0	3,455	5,756	10,501	11,345	0	16,410							
Observed	0	2,967	5,646	5,669	11,132	0	0							
% Estimated	n.a.	14.1	n.a.	46.0	2.0	n.a.	0							

Note: n.a. = Not applicable.

[a] The weir was not operational; daily passage was estimated.

[b] Partial day count, passage was estimated.

[c] The weir was not operational; daily passage was not estimated.

[d] Daily passage was estimated due to the occurrence of a hole in the weir.

[e] Partial day count, passage was not estimated.

Appendix E4.–Historical daily cumulative percent passage of Chinook, chum, and coho salmon at Tatlawiksuk River weir.

	Chinook						Chum					Coho			
Date	1999	2000	2001	2002	2003	2004	1999	2000	2001	2002	2004	1999	2001	2002	2004
6/15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/19	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
6/20	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
6/21	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
6/22	0	1	0	1	0	1	0	0	0	1	2	0	0	0	0
6/23	0	1	0	4	0	1	0	0	0	2	2	0	0	0	0
6/24	0	2	0	4	1	1	0	0	0	2	3	0	0	0	0
6/25	1	2	1	4	1	4	0	1	1	3	6	0	0	0	0
6/26	1	4	4	4	3	12	0	2	1	4	8	0	0	0	0
6/27	1	5	5	28	3	13	1	2	1	6	9	0	0	0	0
6/28	2	5	7	29	12	16	1	2	2	8	9	0	0	0	0
6/29	2	5	8	37	29	19	2	3	3	12	11	0	0	0	0
6/30	3	8	13	38	33	20	3	4	4	14	12	0	0	0	0
7/01	4	11	31	39	35	31	4	6	6	16	15	0	0	0	0
7/02	4	29	32	43	36	36	5	13	7	20	18	0	0	0	0
7/03	5	35	34	48	41	39	6	17	7	22	21	0	0	0	0
7/04	7	39	34	54	43	45	7	19	8	26	23	0	0	0	0
7/05	8	44	40	69	47	53	8	24	10	31	26	0	0	0	0
7/06	9	46	61	72	49	54	9	26	13	38	27	0	0	0	0
7/07	10	48	69	78	50	57	11	29	16	41	30	0	0	0	0
7/08	10	50	70	79	52	60	13	30	20	44	34	0	0	0	0
7/09	12	59	72	80	59	68	16	37	24	47	38	0	0	0	0
7/10	14	65	73	81	61	74	20	40	30	51	41	0	0	0	0
7/11	20	71	74	83	63	76	24	46	33	56	43	0	0	0	0
7/12	28	77	76	84	65	76	28	54	38	59	45	0	0	0	0
7/13	31	78	84	85	71	80	31	57	43	62	49	0	0	0	0
7/14	36	78	86	86	75	81	35	57	48	65	53	0	0	0	0
7/15	37	79	89	90	77	82	38	61	54	70	56	0	0	0	0
7/16	41	81	89	91	78	84	42	66	58	72	60	0	0	0	0
7/17	42	87	90	91	80	89	45	70	63	76	64	0	0	0	0
7/18	52	88	92	92	81	91	49	73	70	80	68	0	0	0	0
7/19	53	89	93	92	83	92	51	75	74	83	71	0	0	0	0
7/20	79	90	94	93	87	92	58	76	77	85	74	0	0	0	0
7/21	80	90	95	93	87	93	61	78	80	87	76	0	0	0	0
7/22	80	92	96	94	88	94	64	82	83	89	79	0	0	0	0
7/23	86	93	96	95	89	95	71	84	85	90	81	0	0	0	0
7/24	89	93	97	95	91	95	74	86	87	91	83	0	0	0	0
7/25	91	94	97	96	92	96	77	88	89	92	85	0	0	0	0
7/26	93	95	98	96	93	96	79	89	90	93	87	0	0	0	0
7/27	94	95	98	97	93	97	82	91	91	94	89	0	0	0	0
7/28	94	95	98	98	94	98	84	92	92	95	91	0	0	0	1
7/29	96	95	98	99	95	98	85	93	92	96	92	0	0	0	1
7/30	97	96	99	99	96	98	88	95	93	96	93	0	0	0	1
7/31	97	96	99	99	97	99	90	96	94	97	94	0	0	0	1
8/01	97	96	99	99	97	99	91	97	95	97	95	0	1	0	2

-continued-

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	Chinook						Chum					Coho			
Date	1999	2000	2001	2002	2003	2004	1999	2000	2001	2002	2004	1999	2001	2002	2004
8/02	98	97	99	100	97	99	93	97	96	98	95	0	1	0	2
8/03	98	98	99	100	98	99	94	98	96	98	96	0	1	0	3
8/04	98	98	99	100	98	99	95	98	97	98	96	0	1	0	4
8/05	98	98	99	100	98	99	95	98	97	98	97	0	2	1	5
8/06	99	98	100	100	98	99	96	98	98	99	97	0	3	1	8
8/07	99	98	100	100	98	99	97	98	98	99	98	1	4	1	11
8/08	99	99	100	100	99	100	97	98	99	99	98	1	5	2	13
8/09	99	99	100	100	99	100	98	98	99	99	99	1	6	2	16
8/10	99	99	100	100	99	100	98	99	99	99	99	1	9	3	20
8/11	99	99	100	100	99	100	98	99	99	100	99	1	11	4	22
8/12	99	99	100	100	99	100	98	99	99	100	99	1	13	8	27
8/13	99	99	100	100	99	100	99	99	99	100	99	1	16	14	30
8/14	100	99	100	100	99	100	99	99	99	100	99	2	25	17	34
8/15	100	100	100	100	99	100	99	99	100	100	99	2	30	18	38
8/16	100	100	100	100	99	100	99	99	100	100	99	3	38	22	41
8/17	100	100	100	100	99	100	99	99	100	100	99	4	44	22	44
8/18	100	100	100	100	100	100	100	99	100	100	99	5	50	25	48
8/19	100	100	100	100	100	100	100	99	100	100	100	6	55	25	52
8/20	100	100	100	100	100	100	100	100	100	100	100	8	60	26	55
8/21	100	100	100	100	100	100	100	100	100	100	100	10	65	36	59
8/22	100	100	100	100	100	100	100	100	100	100	100	11	69	40	64
8/23	100	100	100	100	100	100	100	100	100	100	100	13	73	52	68
8/24	100	100	100	100	100	100	100	100	100	100	100	16	76	61	71
8/25	100	100	100	100	100	100	100	100	100	100	100	18	79	65	75
8/26	100	100	100	100	100	100	100	100	100	100	100	21	82	72	77
8/27	100	100	100	100	100	100	100	100	100	100	100	24	84	75	78
8/28	100	100	100	100	100	100	100	100	100	100	100	29	86	78	80
8/29	100	100	100	100	100	100	100	100	100	100	100	34	87	79	82
8/30	100	100	100	100	100	100	100	100	100	100	100	37	89	80	83
8/31	100	100	100	100	100	100	100	100	100	100	100	42	91	83	85
9/01	100	100	100	100	100	100	100	100	100	100	100	49	92	86	88
9/02	100	100	100	100	100	100	100	100	100	100	100	54	92	88	89
9/03	100	100	100	100	100	100	100	100	100	100	100	58	94	89	91
9/04	100	100	100	100	100	100	100	100	100	100	100	64	94	91	92
9/05	100	100	100	100	100	100	100	100	100	100	100	69	95	93	93
9/06	100	100	100	100	100	100	100	100	100	100	100	72	95	93	94
9/07	100	100	100	100	100	100	100	100	100	100	100	73	96	96	94
9/08	100	100	100	100	100	100	100	100	100	100	100	74	96	96	95
9/09	100	100	100	100	100	100	100	100	100	100	100	76	97	96	96
9/10	100	100	100	100	100	100	100	100	100	100	100	84	97	97	97
9/11	100	100	100	100	100	100	100	100	100	100	100	87	97	97	97
9/12	100	100	100	100	100	100	100	100	100	100	100	89	98	98	98
9/13	100	100	100	100	100	100	100	100	100	100	100	92	98	98	99
9/14	100	100	100	100	100	100	100	100	100	100	100	94	98	99	99
9/15	100	100	100	100	100	100	100	100	100	100	100	96	99	99	100
9/16	100	100	100	100	100	100	100	100	100	100	100	96	99	99	100
9/17	100	100	100	100	100	100	100	100	100	100	100	97	100	99	100
9/18	100	100	100	100	100	100	100	100	100	100	100	98	100	100	100
9/19	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
9/20	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Note: The boxes represent the median passage date and central 50% of the run. Shaded areas represent days the weir was inoperable and daily passage was estimated.